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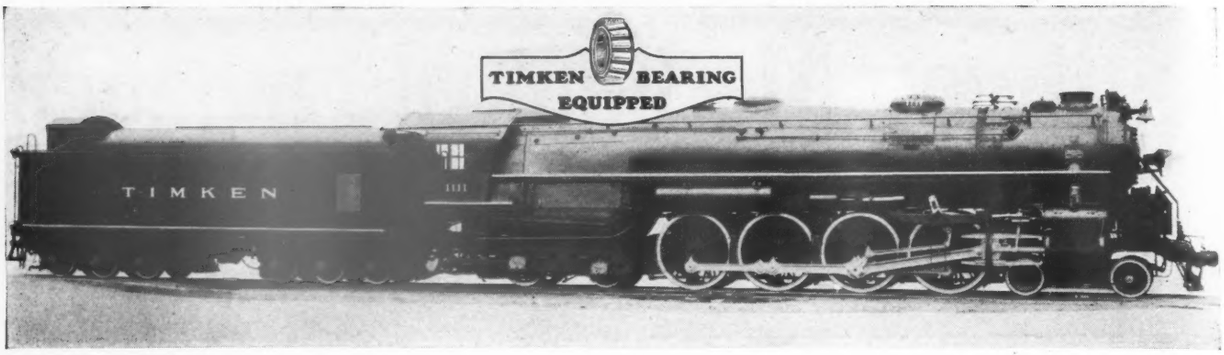


Timken Bearing Equipped From Front Truck To Tender

For the first time in the history of railroading, a locomotive has been placed on a full anti-friction basis, and Timken is proud to have the privilege of pioneering this great forward step in the interest of American railroad advancement.

It is a logical development following the great success which has been attained with Timken Bearings in passenger cars, freight cars, section cars, crossing gates and other railroad equipment during the past several years.

Every wheel of the Timken locomotive turns on Timken Tapered Roller Bearings—front truck wheels, driving wheels, trailer truck wheels and tender truck wheels.

There are 32 Timken bearings in the wheels and booster, and in addition, Timkens are used in the speed driver of the valve pilot and in the train control governor.

Reduction of frictional resistance in the front truck, trailer and tender truck wheels through the use of Timken Bearings is placed at approximately 12%, and in the driving wheels at from 12% to 50%, depending upon load and track conditions.

And largely as a result of the higher rotative speeds secured through the elimination of friction, combined with refinements in the design of reciprocating parts, the Timken locomotive is equally efficient in both fast freight and passenger service, having the power necessary for the former and the speed for the latter.

The performance of Timken Bearings in this engine is expected to radically revolutionize locomotive operation and operating costs, and to eliminate a considerable proportion of motive power maintenance charges as a result of power conservation, lubrication economy, radial-thrust load capacity and greater bearing stamina secured through Timken tapered construction, Timken positively aligned rolls and Timken-made steel—the exclusive combination that is licking Industry's toughest jobs in all types of machinery. The Timken Roller Bearing Co., Canton, Ohio.

TIMKEN *Tapered Roller* **BEARINGS**

Railway
Mechanical Engineer

Founded in 1832 as the American Rail-Road Journal

December, 1930

Whitcomb Oil-Electric Switchers on the Milwaukee

One of the two Whitcomb oil-electric switching locomotives now in heavy industrial switching service on the Milwaukee

Ninety-ton machines show favorable results in comparison with steam power displaced in heavy industrial switching service

TWO 90-ton oil-electric switching locomotives, built by the Geo. D. Whitcomb Company, Rochelle, Ill., for the Chicago, Milwaukee, St. Paul & Pacific, have been in service for a number of months at the Kinzie street (Chicago) yard of that road, performing heavy industrial switching with economy and dispatch and demonstrating marked flexibility in meeting widely divergent load and operating conditions. In addition, the locomotives have reduced substantially the smoke and noise which usually prove such an objectionable feature of steam switching operations in a congested urban community.

A study of the performance of a steam locomotive in similar service over a 24-hr. period indicated a maximum power demand of approximately 500 hp. for handling the peak loads, with an average demand of only 66 hp. over a 24-hr. period. Therefore, in designing the Whitcomb oil-electric locomotive, dual power plants, of 300 hp. capacity each, were used, with controls so arranged that both power plants can function as a unit when handling peak loads, or independently of one another to meet the lighter load requirements.

In regular daily service, it was found that the maximum available power of the locomotive was used only 10 per cent of the total operating time and that 90 per cent of the entire service could be performed with one power plant cut out. This factor alone has effected considerable savings in operating cost by lowering the fuel consumption per locomotive hour, increasing the thermal efficiency of the engine and reducing maintenance costs.

While originally designed as an 80-ton machine, each of the Whitcomb switchers actually weighs slightly over 90 tons and develops a maximum tractive force of 45,000 lb. at starting. Power is furnished by two Waukesha 300-hp., six-cylinder oil engines equipped for the present with carburetors to burn gasoline. The engines are direct-connected to two Westinghouse 600-volt generators which furnish power to four 230-hp., self-ventilated traction motors. Each of these motors is geared to a driving axle through single-reduction spur gearing. The axle journals are mounted in roller

bearings to minimize friction and wear, the Timken tapered roller type being used. The locomotive spring rigging is side-equalized and cross-equalized to permit safe operation over rough track. Curves in excess of 22 deg. can be negotiated.

The cab elevation and design are such as to provide clear vision in all directions. Cab controls are located so that the operator can work from either side of the cab, transferring to either control station easily and without loss of time. This arrangement permits of one-man operation, effecting a substantial reduction in crew expense.

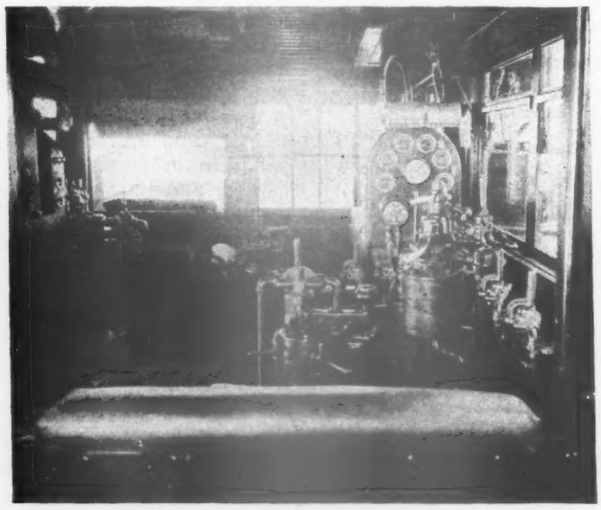
Principal dimensions and equipment of the Whitcomb oil-electric switching locomotives

Type	0-8-0
Weight on drivers	182,780 lb.
Size drivers	38 in.
Journal bearings 6 in. by 11 in.	Timken
Wheel base rigid	13 ft. 6 in.
Wheel base total	13 ft. 6 in.
Length, center to center of couplers	29 ft. 6 in.
Length over cab	8 ft. 0 in.
Height over all	15 ft. 2 in.
Width over all	10 ft. 6 in.
Starting tractive force, maximum	45,500 lb.
Equipment	
Engine—Waukesha, Type 6 O.K.	2
Bore	7¾ in.
Stroke	8½ in.
Nominal hp.	300
Generators—Westinghouse, Type 181-C3	2
Volts	600
Traction motors—Westinghouse, Type 584 BH 2	4
Rating for one hour (per motor) at 600 volts, 312 amps., 510 r.p.m.	230 hp.
Gear ratio	16 to 70
Air compressors—Gardner-Denver	2
Capacity (per compressor)	59 cu. ft. per min.

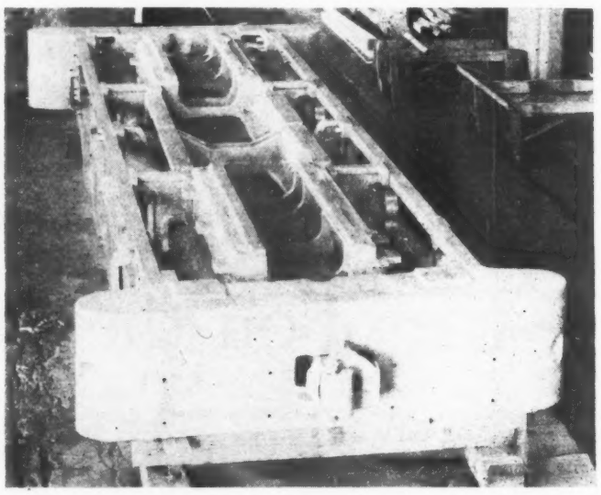
Service Performance on the Milwaukee

The Whitcomb oil-electrics, when delivered to the Milwaukee, were placed in service on the lead of a classification yard, replacing consolidated type steam locomotives weighing 189,000 lb. on the drivers and having a tractive force of 43,000 lb. They were operated during unusually severe weather in the early part of the present year, successfully handling the work previously performed by the steam locomotives. On one day when the temperature range was between zero and 10 deg. F. above, 341 cars were handled by one locomotive in 6 hr. 40 min. actual switching time.

It was noted that the oil-electric locomotives do not handle cuts of 25 to 30 cars quite as rapidly as steam power, but this loss is overcome by more rapid acceleration and less loss of time when changing the direction of motion when cuts of approximately 15 cars are being switched. In all industrial districts where smaller cuts of cars are handled and the work consists of supplying switching service to industries and wholesale houses over quite a large territory, the oil-electric will handle more work in a given period of time than can be performed by an 0-6-0 switching locomotive weighing 125,000 lb. on the drivers and having a tractive force of 28,000 lb.



Interior cab view showing dual control stations and equipment



The engine frame is thoroughly cross-braced and of rigid construction

The industrial assignment of switching power at the Kinzie street yard covers a period of 24 hr. daily except Sunday and it has been found practicable to assign the oil-electric locomotive to 24-hr. service and work it through the entire six days without relief, using the time between Saturday afternoon and Monday morning for needed repairs.

Fuel, sand and water are provided once each 24 hrs. between change of shift, thus eliminating the necessity of sending a relief locomotive and crew each 16-hr. period, as required with steam locomotives, in order that they may return to the enginehouse for fire cleaning and repairs.

The standby expense of relief steam power is also avoided, as well as the cost of one locomotive turn each 24 hrs. and it, therefore, becomes practicable for two oil-electric locomotives to perform exactly the same amount of work previously performed by three steam units. Further savings are effected due to the reduced crew expense, lower cost of fuel and reduced cost for mechanical repairs.

Still another operating advantage is the increased time which the oil-electric locomotive can be employed actually moving cars, particularly in winter when the operation of steam power on spur tracks and around buildings is considerably delayed, due to smoke and exhaust steam obscuring the switching crews' vision to the extent that movements are slow and, in some cases, stopped for several minutes until the smoke and steam clear away.

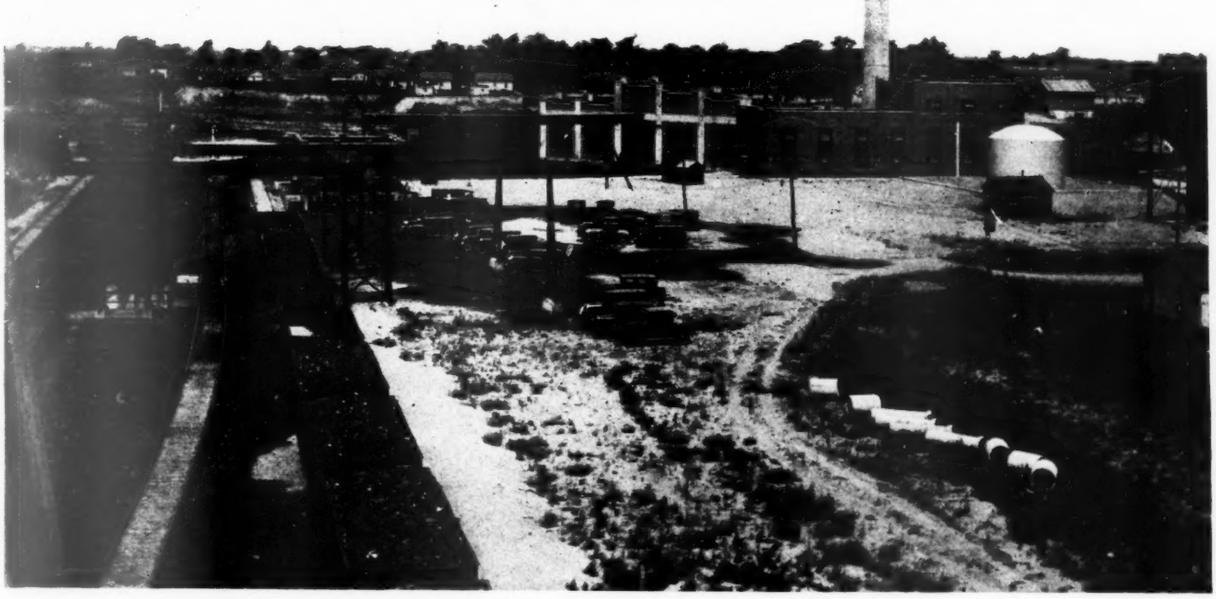
Important Details of Construction

The Whitcomb oil-electric switching locomotive, of the 0-8-0 type, is designed with a rigid wheel base of 13 ft. 6 in. The side frames are made of heavy steel

(Concluded on page 685)

Grand Trunk Western Builds Enginehouse at Pontiac

Oil-fired boiler plant furnishes steam for holding locomotives under pressure by direct steaming



A general view of the Pontiac terminal from the top of the coaling station

THE Grand Trunk Western recently placed in service a new engine terminal at Pontiac, Mich., which replaces the old terminal formerly located in the heart of the city. The new layout is designed to accommodate the despatching of approximately 40 locomotives a day and is complete in every respect necessary for the handling and running maintenance of power at an outlying point. The locomotives despatched from Pontiac operate to Cassville, Durand, Detroit and Port Huron in Michigan and to Toledo, Ohio.

The enginehouse is a 10-stall structure having wood-frame, brick walls, concrete columns and beams and a concrete floor. The windows are steel sash. The roof of the house is of wood and because of the direct steaming installation no smoke jacks were used. There are two small ventilators located in the roof over each stall. Adjacent to the enginehouse and connected thereto are enginemen's and mechanics' wash and locker rooms and the power plant and machine shop. Two pits in the enginehouse are equipped with a Whiting 50-ton drop table and three other pits have depressed rails for changing springs. The outside circle walls are protected against damage from locomotives running over the ends of the pit tracks by small depressed pits at the ends of the rails. All of the timber work on the interior of the house is finished with aluminum paint.

The Pontiac enginehouse is designed for ultimate expansion into a 25-stall house, there being 15 outside tracks, 10 of which are completely equipped with blow-off and direct steaming drops, and flood lighting. The outside direct-steaming drops are on the holding line only while the 10 inside stalls have both holding and boosting-line drops. These outside tracks are served at their outer circle by an eight-foot concrete runway for the convenience of trucks and trailers.

The terminal is served by a 300-ton coaling station of the mechanical type designed and erected by the Ogle

A locomotive being fired-up on the lead track—Note the absence of smoke

Construction Company, Chicago. The coaling dock also has sand storage facilities for two carloads of wet sand and sand drying equipment of sufficient capacity to care for the maximum demands. The dry sand storage is of 200 tons capacity.

The ash pit is a two-track deep-water type with a 60-foot Shaw overhead traveling crane of four tons capacity equipped with a clamshell bucket. The water pit is of sufficient capacity to hold the cinders from 50 to 60 locomotives without cleaning out. The crane runway extends beyond the area of the two pit tracks and permits the ground storage of 1,200 cubic yards of cinders when it is not desired to load directly into cars. The overhead crane is also used for the loading and unloading of sand.

The enginehouse is served by a 90-foot Bethlehem twin-span three-point suspension turntable equipped with overhead power collector and floodlights.

Adjacent to the lead tracks is the storehouse building in which local stores are kept. In this building is also located the locomotive supply room where the enginemen's tool kits are stored prior to placing them on outgoing locomotives. In the basement of the storehouse is the oil supply storage room for lubricating oils. The offices of the general enginehouse foreman and crew despatcher are in this building.

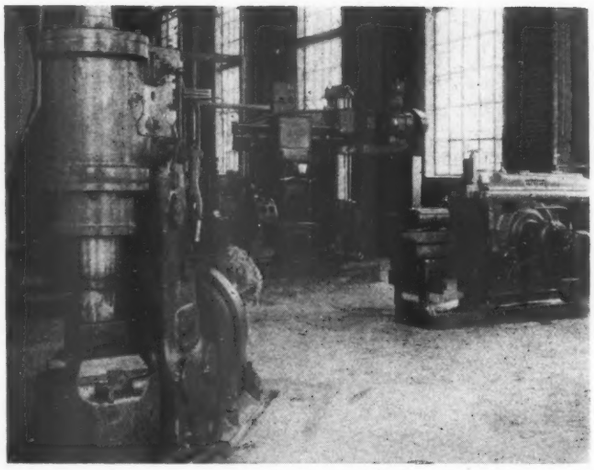
On the outgoing lead there is a fire-up station where the locomotives are fired-up by means of oil torches fed with fuel oil through pumps located in the power plant. These fire-up torches are used to ignite green coal on the grates and the time consumed in firing up is usually from eight to ten minutes.

The water supply for locomotives is provided for by a 100,000-gallon storage tank with water cranes on both inbound and outbound tracks.

Electric Lighting

The enginehouse lighting is provided by means of a total of 10 fixtures for each stall. The lights alongside the working pits are set on brackets on the columns with the reflectors set at an angle. There are two lights on each side of the pit. These are equipped with 75-watt lamps. The lights on the outside and inside circle of the house are of a similar type equipped with 100-watt lamps. The pit lights are controlled from individual switches while the inner and outer circle lights are on another circuit controlled from a switch on the panel board in the power plant. The machine shop and the boiler room are lighted by overhead reflector-type lights with 100-watt lamps. The outdoor stalls are lighted by fixtures mounted on the pipe-canopy supports. These are equipped with 75-watt lamps.

The enginehouse interior is brightened by the use of aluminum paint



The enginehouse machine shop is completely equipped with new machine tools

The Machine Shop

The machine shop at the Pontiac terminal is typical of the modern trend in engine terminal running repair shops in that it is equipped with new machine tools which were purchased especially for this service. The following machines are in the shop:

One Type B No. 3 Nazel motor-driven pneumatic hammer
One No. 131 Ranson motor-driven floor grinder
One 28-in. American ram shaper, motor driven
One Monarch 14-in. by 8-ft. geared-head motor-driven engine lathe
One 36-in. Carlton radial drill.

There are also several portable oxy-acetylene welding outfits for use around the plant.

Direct Steaming

The 10 inside stalls of the enginehouse are equipped with boiler washing, blow-off and both holding and boosting steaming lines. In this part of the house the piping consists of 3-in. wash-out main, 4-in. blow-off line, 4-in. high-pressure steam main and a 3-in. filling line. On the 10 outside stalls, there is a 2½-in. blow-off line and a 3-in. high-pressure steam line for holding locomotives under steam pressure. All of the inside stalls and 10 of the outside stalls are equipped with direct steaming drops. One interesting feature of the piping on the outside stalls is a canopy that has been built over the pipe line to protect it from the weather as well as to provide a convenient means of performing maintenance work on the line. One of the illustrations shows the arrangement of this canopy. The engineering service on the direct steaming installation was furnished by the Railway Engineering & Equipment Company, Chicago, and the entire piping installation including the boiler, oil burner and engine washing facilities was made by the Johnson-Larsen Company, Detroit, Mich., to the designs and specifications of the railroad company's mechanical engineering department.

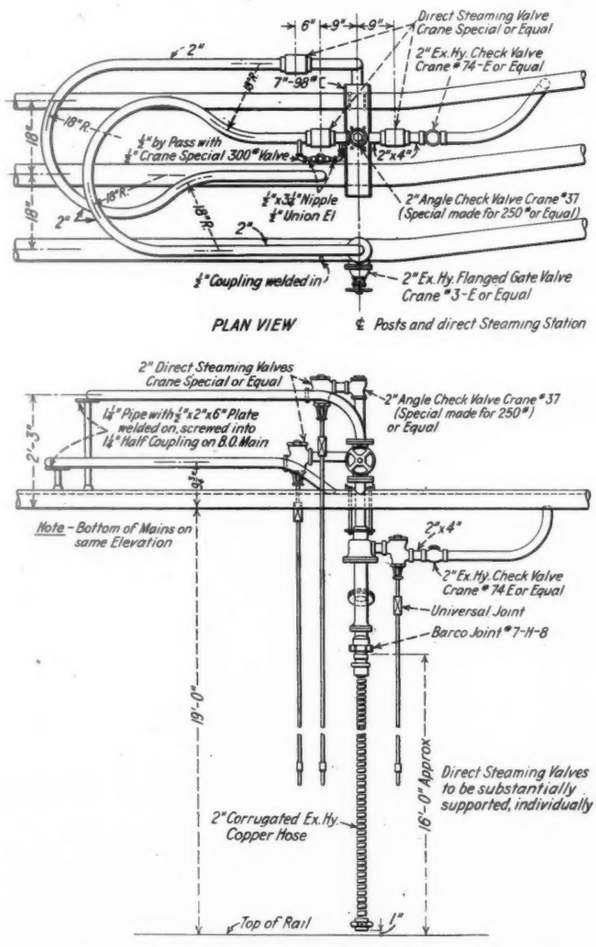
Boiler Plant

At the Pontiac terminal the boiler plant has been designed to serve the terminal as a fireless terminal with adequate capacity to supply any maximum demand that may be made for holding locomotives under pressure or boosting the pressure on locomotives that have been blown down for wash-out or repairs. Steam is

supplied by two 304-b. hp., four-drum Union bent-tube Stirling-type water-tube boilers set in a battery. These boilers are 10 ft. from boiler-room floor to center of mud drums. The volume of combustion chamber was designed to permit the passage of a maximum of about 14,600 cubic feet of air per minute based on a rate of 300 cubic feet of air per pound of fuel oil burned. The fuel-oil system is designed to burn a maximum of six gallons per minute. The working pressure of these boilers is 225 lb. per square inch. The boilers are not equipped with superheaters. Natural draft only is used—this being supplied by a reinforced concrete stack having an inside diameter of 72 in. at the top and a total height of 185 ft.

Fuel System

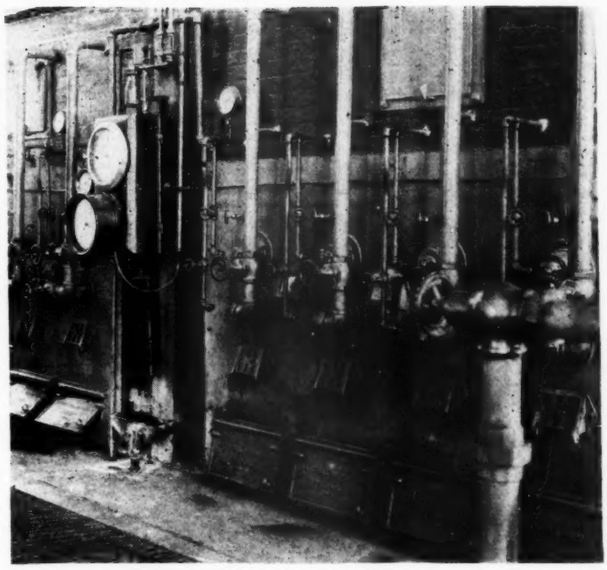
The fuel used is a 12 to 16-deg. Baumé gravity Oklahoma fuel oil averaging 152,000 B. t. u. per gallon. When the plant was first started up, an oil having a


6"
9"
9"
Direct Steaming Valve Crane Special or Equal
2"
2" Ex. Hy. Check Valve Crane #74-E or Equal
7"-99°-C
18" R.
18"
18" R.
¼" by Pass with ¼" Crane Special 300# Valve
2"x4"
18"
18" R.
2"
¼"x3½" Nipple
1" Union El
2" Angle Check Valve Crane #37 (Special made for 250# or Equal)
2"
¼" Coupling welded in
2" Ex. Hy. Flanged Gate Valve Crane #3-E or Equal
PLAN VIEW
℄ Posts and direct Steaming Station
2" Direct Steaming Valves Crane Special or Equal
2" Angle Check Valve Crane #37 (Special made for 250#) or Equal
1½" Pipe with ¼"x2"x6" Plate welded on, screwed into 1½" Half Coupling on B.O. Main
2'-3"
Note - Bottom of Mains on same Elevation
2"x4"
2" Ex. Hy. Check Valve Crane #74 E or Equal
Universal Joint
Barco Joint #7-H-8
19'-0"
Approx 19'-0"
Direct Steaming Valves to be substantially supported, individually
2" Corrugated Ex. Hy. Copper Hose
Top of Rail
1"

Piping details of the drop pits in the enginehouse

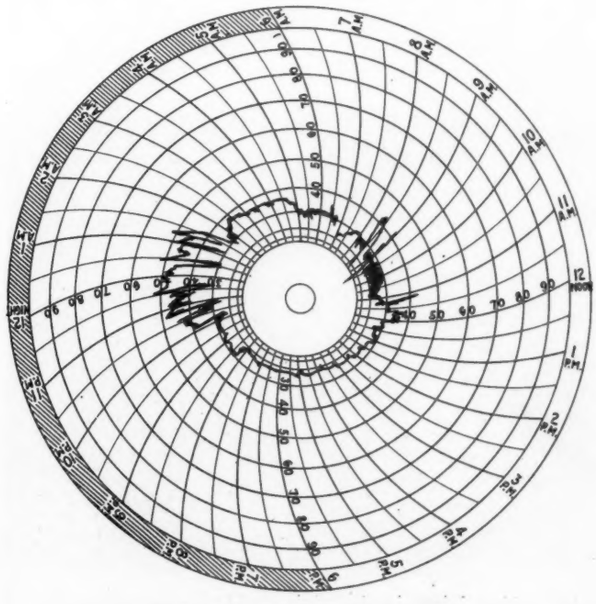
gravity of 22 to 26 deg. Baumé was used, but it was found that an approximate saving of 17.5 per cent could be made by using the heavier grade of oil mentioned above. A good grade of oil is now being used having a Baumé gravity of from 14 to 16 deg., a flash point of 200 deg., and a burning point of 225 deg. This oil has a viscosity of 300 or less at 100 deg. F. and runs less than one per cent sediment and water and less than one per cent sulphur content.

The oil is received at the boiler plant in tank cars and

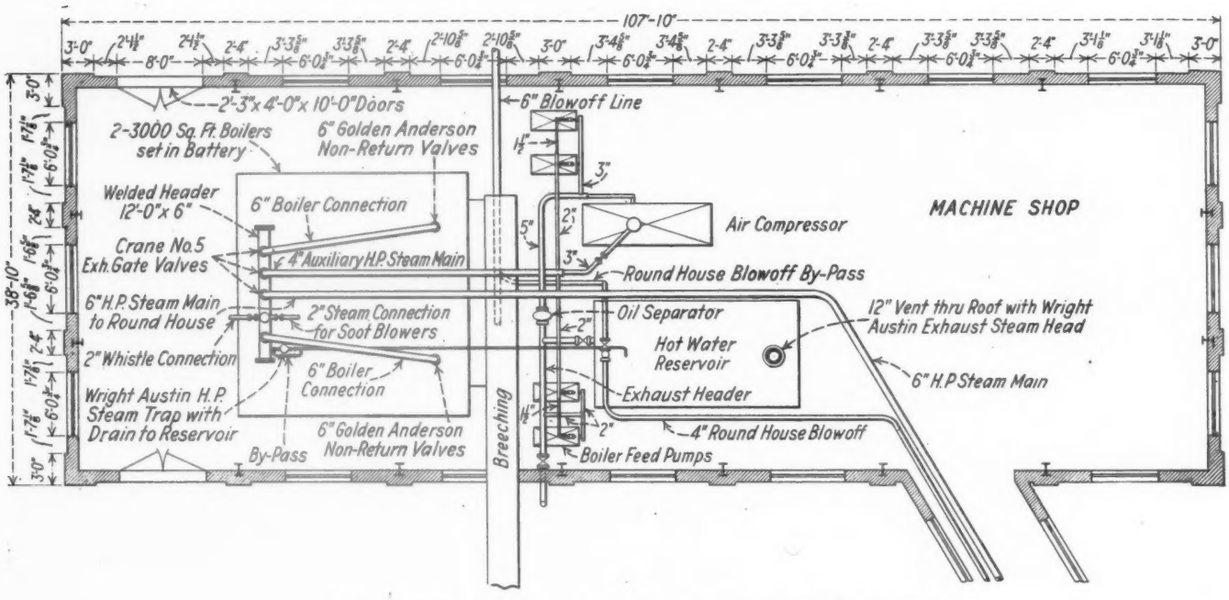


The oil burners, showing the two sets of burners, the dampers, steam-flow meter and CO_2 recorder

is removed through an overhead swivel joint connection attached to the suction side of a 6-in. by 3½-in. by 6-in. duplex steam pump with brass bushings in the oil end. From this pump the oil is transferred to a 100,000-gallon storage tank entering the tank at the top and being discharged at several points on the bottom of the tank, thereby effecting a constant agitation of the sediment and water, keeping these distributed through the oil. The outlet from the tank is through a 3-in. suction line equipped with a foot valve and a one-inch steam coil around the suction inlet. This line carries the oil back to the boiler room where it passes through a double strainer into two oil-burner pumps. These two pumps are of the rotary type and are each equipped with a gas- and air-elimination chamber on the discharge side. The combination of the rotary feature and the elimination chamber permits the delivery of the fuel oil to the burn-



Steam-flow meter recording chart



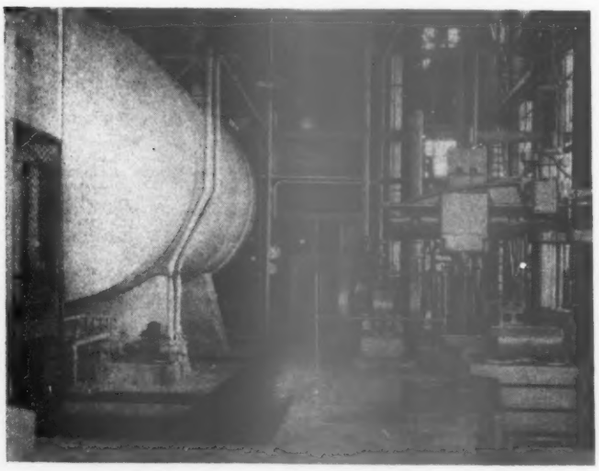
General arrangement of high- and low-pressure steam piping

ers without pulsation. This is a condition much to be desired in an oil-burner installation. The pumps are inter-connected so that either can be used should one break down. The oil is passed from the pump through a second strainer into two oil-heater tanks having 16 sq. ft. of heating surface each and automatic steam regulation. These tanks are arranged for operation individually or in series, or they can be entirely by-passed in case it is necessary to make repairs.

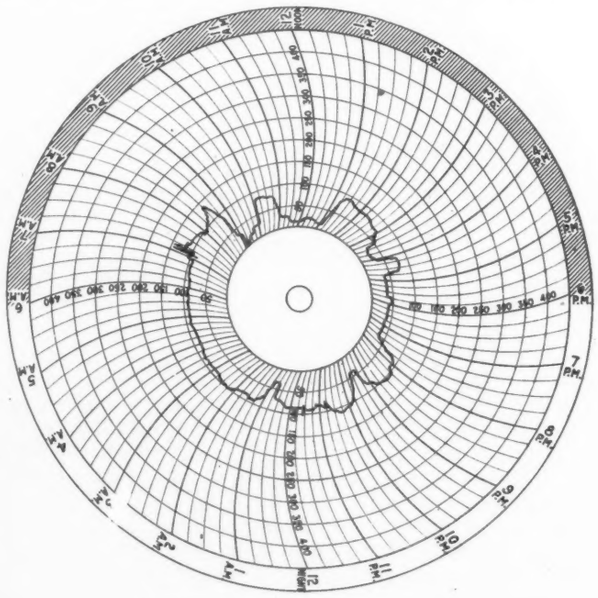
Oil Burner Equipment

The oil burners on the boilers are Billow model GSK burners manufactured by the National Supply Company, Chicago, and are divided into two sets, one of which is in regular operation and is of the low-pressure air type, operating on a maximum pressure of two pounds of air delivered to the burners by a General Electric turbine compressor. The oil pressure on the burners varies from 10 to 50 pounds per square inch depending upon the load on the boilers. There are four burners of the low pressure type on each boiler, eight on both boilers. In addition, there are eight steam-atomizing burners, four on each boiler, which operate only in an emergency should the low-pressure burners be out of service. This is because the steam-atomizing burners use about seven per cent of the steam generated by the boilers which places a penalty on the delivery of oil to the combustion chamber.

The burners are mounted below and back of the mud drum and the air is regulated by means of dampers which permits it to flow through a specially designed grill work below the burners, thus diffusing the air over the entire area below the flame in such a manner as to produce an even feed as combustion occurs. The flames impinge upon a deflecting wall which produces a turbulence, filling the chamber and eliminating air pockets. The surplus oil flowing to the burners is returned through a relief valve to the oil storage tank which serves as a protection against excess pressure on the

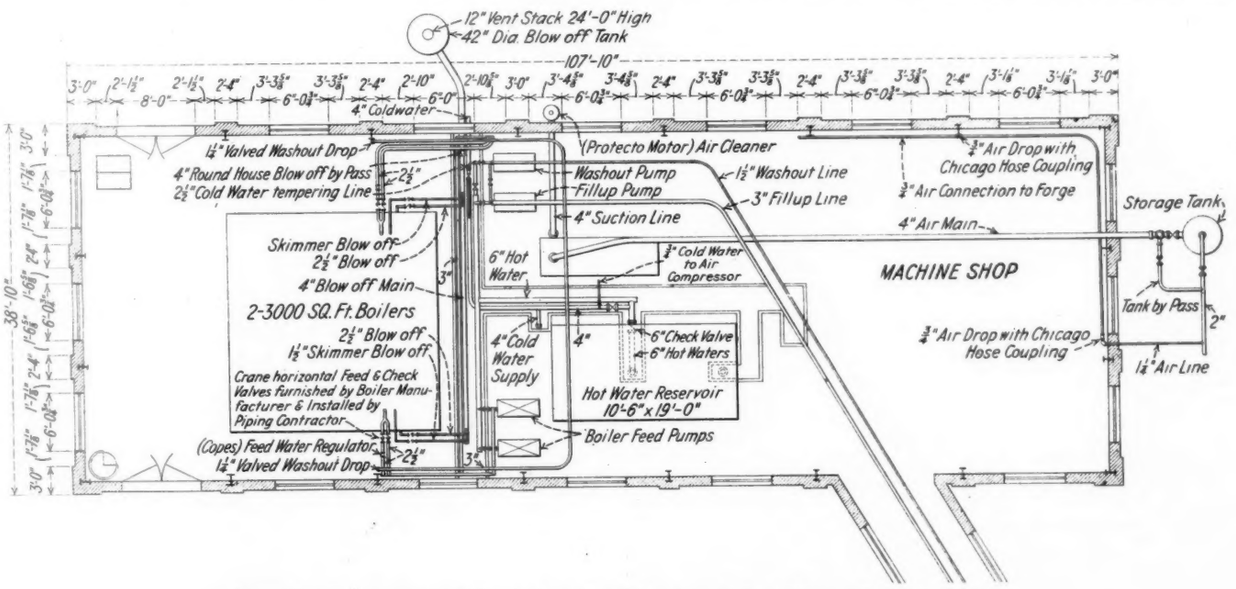


The welded joints in the piping add to the appearance of the boiler room



Boiler feed-water meter record

equipment. All four burners on each boiler are adjusted to equal flame length and the fuel feed is governed by a master valve at the pumps which lowers or raises the pressure of the oil as the load on the boiler varies. This fuel control valve is manually operated by the attendant in accordance with the reading of the steam-flow meter on the enginehouse line. The meter immediately reflects the application of direct steaming to any locomotive and warns the boiler-room attendant that the oil pressure to the burners must be changed in order to meet the increased load. Where the demand for steam falls to a point below that which requires the operation of four burners, individual burners may be cut out without affecting their adjustment. At a minimum demand one burner may be sufficient for several hours. This arrangement provides means for adjusting instantly the fuel supply to the load, making possible a considerable saving that would not be possible with a coal-fired plant. At times, when the load is low and exhaust steam is not required for feedwater, the steam air compressor is cut out and an electric compressor is cut into service, thereby relieving the demand on the boilers. For feeding oil to the burners in an emergency, the oil transfer pump is so inter-connected with the oil


12" Vent Stack 24'-0" High
42" Dia. Blow off Tank
107'-10"
4" Coldwater
1¼" Valved Washout Drop
4" Round House Blow off by Pass
2½" Cold Water tempering Line
(Protecto Motor) Air Cleaner
Washout Pump
Fillup Pump
1½" Washout Line
3" Fillup Line
¾" Air Drop with Chicago Hose Coupling
¾" Air Connection to Forge
Storage Tank
4" Suction Line
4" Air Main
Skimmer Blow off
2½" Blow off
4" Blow off Main
6" Hot Water
¾" Cold Water to Air Compressor
MACHINE SHOP
2-3000 SQ. Ft. Boilers
2½" Blow off
1½" Skimmer Blow off
4" Cold Water Supply
6" Check Valve
6" Hot Waters
Tank by Pass
2"
¾" Air Drop with Chicago Hose Coupling
1¼" Air Line
Crane horizontal Feed & Check Valves furnished by Boiler Manufacturer & Installed by Piping Contractor
Hot Water Reservoir 10'-6" x 19'-0"
Boiler Feed Pumps
(Copes) Feed Water Regulator
1¼" Valved Washout Drop

General arrangement of the hot- and cold-water piping, blow-offs and air lines

burner pumps that when these are shut down for any reason, the transfer pump can perform the same function.

Fuel oil is stored in a 100,000 gallon tank outside the boiler plant. The storage of such a quantity of oil permits the purchase of fuel in large quantities, thereby making it possible to take advantage of lower fuel prices. For safety and fire protection all pipe connections to the tank are made overhead and an approved screen-protected gas vent has been provided. The tank itself is surrounded by a 5 ft. 6 in. concrete dike which will hold 150,000 gallons. This dike is additionally protected by an inside sand wall which prevents oil leaking out through any cracks in the concrete which may be developed in case of fire.

Boiler Operation

It has been found that the boilers operate at the greatest efficiency with a CO_2 reading of 12 to 14 per cent and an up-take draft of .12 in. of water. Average evaporations of 15 and 16 lb. of water to a pound of fuel oil are obtained regularly at this plant. Two of the illustrations show charts selected at random, all of which are for the same day's operation. One is from the steam-flow meter, and the other shows the amount of boiler feedwater used. On the date that these charts were made, the plant was operating on Oklahoma fuel oil of 14 deg. Baumé gravity and during 24 hours, 2,837 gal. of fuel oil were used, weighing 18,725 lb. In the same period 290,700 lb. of water were evaporated, making an average evaporation of 15.5 lb. of water to one pound of fuel oil.

The boiler feed water is controlled by Copes feedwater regulators, working in conjunction with Copes differential governors. The boiler feedwater may also be controlled by hand-operated valves. The raw feedwater used at Pontiac has a hardness of about 22 grains per gal. and it is necessary to treat it with boiler compound. Skimmer blow-offs on each of the top rear drums of the boilers remove the concentrations and very little trouble has been experienced with scale. The boiler feedwater is obtained by gravity from a 10-ft. by 20-ft. circular tank mounted horizontally a sufficient distance above the floor level to provide a head which will prevent the hot water from breaking into steam as it passes through the water end of the pump.

Float controls on the tank maintain the correct water level by allowing cold water to spray through inlets properly placed in the top of the tank. All exhaust steam from boiler-room auxiliaries is carried into this tank by a 5-in. exhaust line entering one end of the tank and discharging below the water level. Steam escaping above the water line is condensed by the cold water sprays. When locomotives that are due for a washout are taken into the enginehouse, they are blown back into a baffled separating box mounted in one end of the tank. This box has an outlet outside of the tank which is sealed. The dirty water from the locomotives passes through the box while the steam and the vapor is separated by the baffles and the latent heat extracted by condensation under the cold-water sprays. Hot wash-out and fill-up water is provided by the same tank, the wash-out water being tempered by a cold-water tempering valve at the pump to the proper tem-

perature for handling. The tank is vented to the atmosphere and the small amount of vapor that escapes the cooling sprays passes off through the vent, eliminating back pressure in the tank.

Several unusual features are to be found in the piping arrangement of this terminal. All of the piping has been installed where possible by means of welded joints presenting an extremely neat appearance and eliminating the necessity for built-up insulation. Although there were a great many welds in the piping, no leaks developed when the final tests on the lines were made. Another feature is in connection with the 10 direct steaming drops installed on the out-door tracks. These drops and the connecting lines are run overhead under a covered canopy which was designed to permit working on the lines and still offer weather protection for the piping. The canopy is lighted for night work.

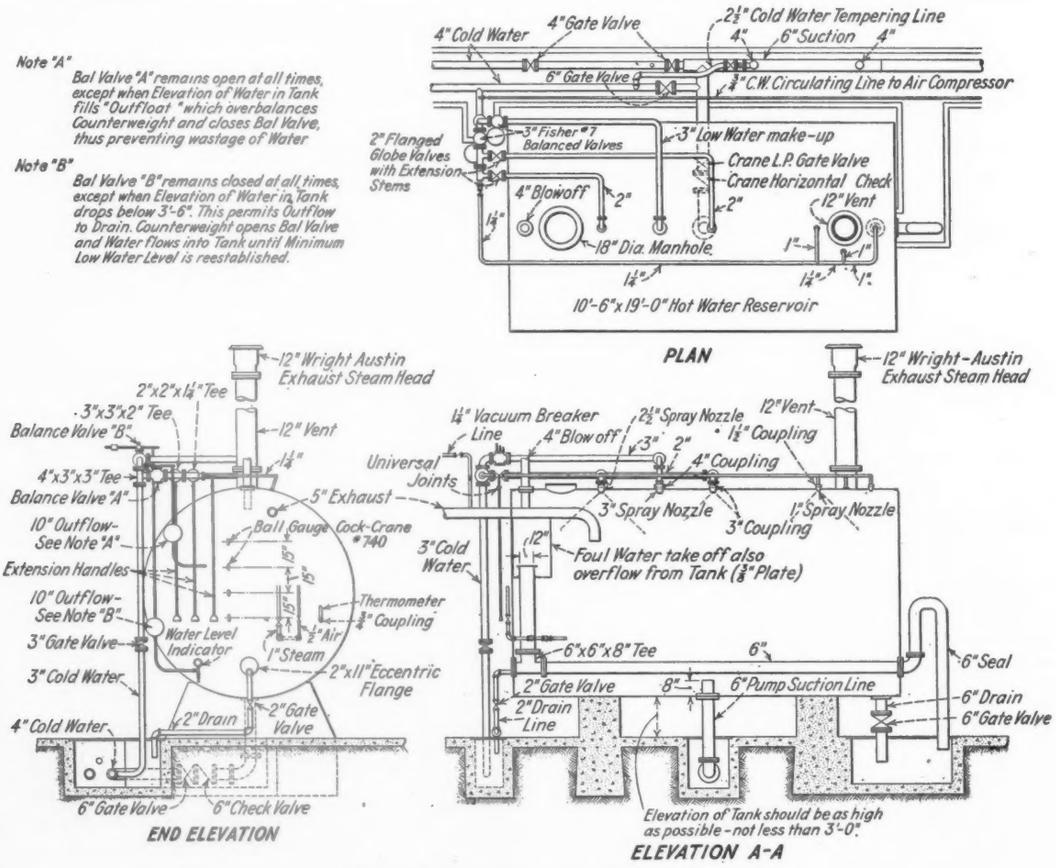
It has been found that with the direct steaming system, the radiation from locomotives provides heat for the enginehouse during the winter months. There has, however, always been a certain amount of condensation which collects on the inside of the roof members. This has been eliminated by four Modine unit heaters located at uniform intervals around the outside circle of the house near the roof, providing a circulation of warm air which not only stops condensation but supplies what little additional heat is required to maintain a comfortable working temperature in the enginehouse. These unit heaters are furnished with steam from the steam traps draining the main steam lines throughout the enginehouse. The condensation from these traps having been secured from steam at 225 lb. pressure flashes into steam again at the lower pressure used in the unit heaters. Make-up steam is supplied as required through a reducing valve. The return is taken into the feedwater tank in the boiler room in the winter and in the summer the unit heaters are by-passed and the condensation is returned in the same manner. In extremely cold weather a vacuum pump is available to take away the condensation as rapidly as conditions may require. Unit heaters being equipped with three-speed fans can be regulated to supply the required amount of heat. Each unit heater has a capacity of 650 sq. ft. of radiation.

Boiler Room Auxiliaries

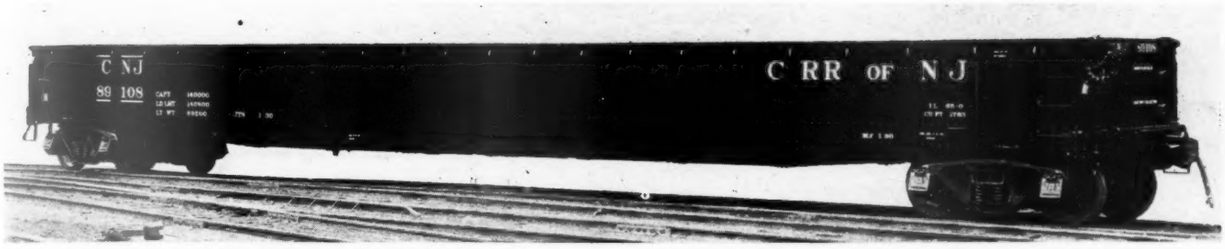
Two 7½-in. by 5-in. by 6-in. Union duplex boiler feed pumps
One 7½-in. by 5-in. by 6-in. Union general service duplex wash-out pump.
One 6-in. by 3½-in. by 6-in. American Steam Pump Company duplex steam oil-transfer pump
Two Electric rotary oil pumps (six gal. a min. capacity).
Two Oil haeters (16 sq. ft.. heating surface)
Two Tuthill motor-driven oil pumps for circulating oil to firing-up station
One Wagner simplex vacuum pump
One 12-in. by 12-in. by 12-in. single-stage Union steam-driven air compressor, capacity 250 cu. ft. free air per min.
One Duplex 9-in. by 5¼-in. by 10-in. fill-up pump. (Union Steam Pump Company)
One Chicago Pneumatic motor-driven compressor 9 in. by 8 in. single-stage. Capacity, 147 cu. ft. free air per min.

Boiler Room Instruments

One Brown 12-in recording thermometer for feedwater temperature
One Republic steam flow meter on direct-steaming lines
One Bailey water meter for boiler feed line
Two Hays draft gages (double)
One Hays CO_2 recorder



Details of hot-water reservoir and piping



New Jersey Central 65-ft. gondola car built by the Bethlehem Steel Company

New Jersey Central Buys 200 65-Ft. Gondolas

70-ton cars designed with inside width of 7 ft. 9 in.—Light weight, 69,300 lb.

THE Central of New Jersey recently placed in service 200 70-ton capacity all-steel gondola cars of exceptional length designed especially for carrying structural steel shapes. These cars, bearing road numbers 89000 to 89199 inclusive, were built by the Bethlehem Steel Company, Johnstown, Pa. They are provided with Hutchins drop-end doors and steel floors. A feature of particular interest is that in spite of their great length they are so arranged to negotiate curves of 90-ft. radius, thus enabling them to traverse readily most of the curves encountered in railroad yards and on manufacturers' sidings.

The total length of cars over the end sills is 67 ft. The extreme width is 8 ft. 6⅛ in. over the guard angles and the height from the top of the rail to the top of the sides is 7 ft. 2¼ in. The net inside length is 65 ft., inside height, 3 ft. 6 in.; inside width 7 ft. 9 in., and the cubic capacity level full is 1,763 cu. ft., while the light weight of the car is 69,300 lb.

The Underframe

Particular attention was given to the design of the underframe of these cars, which, on account of their length, had to be carefully laid out to provide ample clearance between the top of the rail and the bottom of the center sill, when passing such locations as the humps in classification yards, and also to give proper clearance for the trucks on the sharper curves.

The underframe is of the built-up type with fish-belly center sills. The latter are built integral with the draft sills, spaced 12⅞-in. apart and extend from one striking plate to the other. The center sill webs are of ½-in. plate. They are continuous without splices between the draw-gear back stops, and have a 4-in. by 3½-in. by ½-in. angle outside at the top, and 4-in. by 3½-in. by ⅝-in. angles inside and outside at the bottom. The depth of the center sill, for a distance of 33 ft. 6 in. at the center portion of the car, is 22 in. over the angles. The bottom of the center sill clears the top of the rail by 1 ft. 9⅞ in. From the ends to a point 18 in. behind the bolsters, the center sill is 13¾ in. deep, from which depth it slopes down to meet the greater depth of the center portion. A cover plate 7/16 in. thick and 22½ in. wide, extends without splice the entire length of the center sills from one end sill to the other.

The side sills are built-up integral with the side construction and provide a clearance at the trucks of 2 ft. 10 in. from the top of the rail, while at the center portion they extend to within 2 ft. 1¼ in. of the rail.

End sills are of 12-in. channel weighing 25 lb. per foot and are in two pieces, each of which extends from the center sill to the side of the car. A cover plate extending the full width of the car, in the form of a pressed-steel angle 7/16 in. thick, is securely riveted to the end sill, center sills and corner stakes.

The body bolsters are built up of four pressed-steel diaphragms ⅜ in. thick, having closed corners, two on each side of center sill. The flanges are turned outward and the diaphragms in the webs are spaced 7½ in. back to back. Top and bottom cover plates of ⅝-in. by 16-in. steel extend the full width of the car. The bolster center filler is combined with the draft-gear back stop in a single steel casting secured with ⅞-in rivets. Cast-steel fillers are also applied between the bolster webs at the side bearings. Pressed steel U-shaped connections ⅜ in. in thickness secure the bolster at the side sills, in addition to rivets in the end flange of the bolster webs.

The end-sill diagonal braces are made of pressed steel of channel section, 5/16 in. thick and 6 in. wide, with the flanges turned downward. They are applied at each corner of the car and are so arranged as to provide ample clearance for the wheels.

There are nine crossbearers, one located at the center of the car with the remainder spaced 5 ft. 7 in. between centers. They are constructed with pressed steel diaphragms 5/16 in. thick, flanges 3¼ in. wide with closed corners. The top cover plates are ⅜ in. by 6 in. placed on top of the floor plates and extend the full width of the car. The bottom-crossbearer tie plates are of ⅜-in. steel, 6 in. wide, pass under the center sills and are securely riveted to the center and side sills. Pressed steel pans of 5/16-in. plate with closed corners are applied between the center sills at each crosstie.

The center plates for the body consist of steel drop

forgings to A.R.A. standard contour and are riveted to the body bolster with eight ¾-in. rivets in each center plate.

Built-up sides of the plate girder type, 5 ft. 1 in. deep over the angles, extend for a distance of 33 ft. 6 in. at the center portion of the car, and then decrease in depth to 4 ft. 4⅞ in. at a point 5 ft. 9¼ in. back of each bolster, continuing from there at this depth to the end of the car.

The top of the sides is 3 ft. 6 in., inside, above the top of the floor. The side web plates are of 5/16-in. copper-bearing steel arranged in three sections with splice plates, ⅜ in. by 7¼ in., on the inside. The end side sheets are flanged and riveted to the corner stakes with rivets, countersunk on the inside. Bulb angles, 5 in. by 4½ in. by 7/16 in., 19.3 lb. per foot, are used at the top of the sides and are continuous without splices. The bottom angles are also continuous, being 5 in. by 3½ in. by ⅝ in. Side stakes of 5/16-in. copper bearing steel of pressed design 4 in. deep and 7¼ in. wide, extend the full depth of the side. There are 23 of these stakes on each side of the car. The corner stakes are ½ in. in thickness and are provided with a stiffening flange at the end-door stop. Twelve sets of stake pockets of the hinged type forged of mild steel are located on the inside of the car on each side.

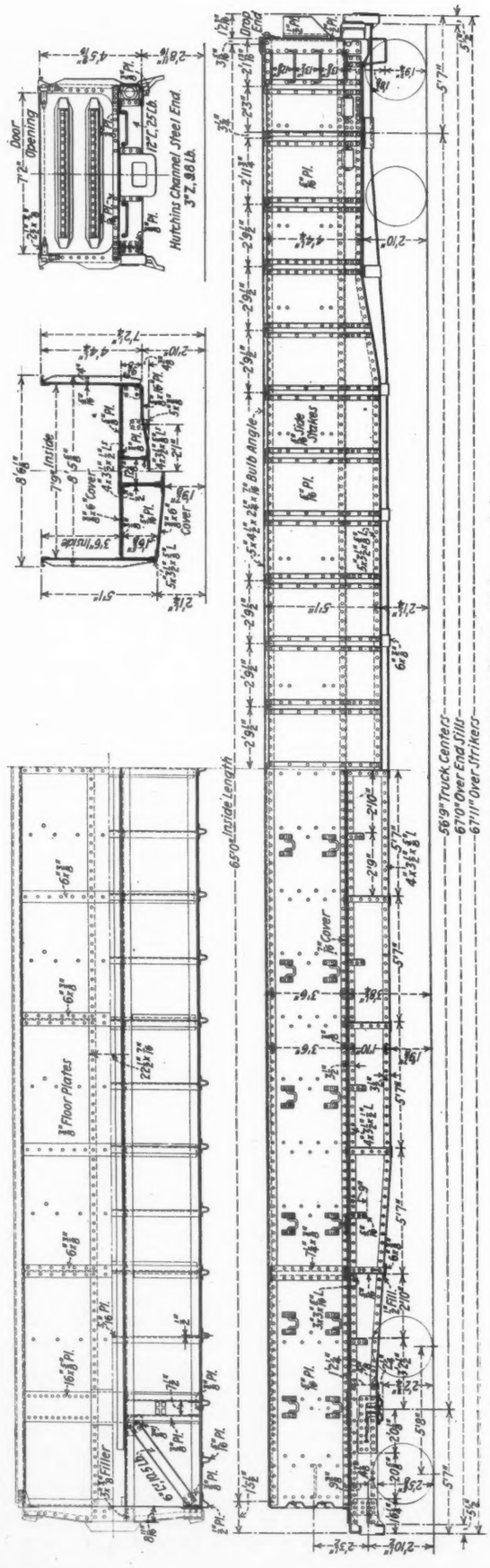
The flooring is of ⅜-in. copper-bearing steel, arranged in 12 panels, six on each side of the center sill, flanged upward at the side sheets and lapping the center-sill top

Principal dimensions of the Central of New Jersey 65-ft. gondola cars

Length over pulling face of couplers	70 ft. 5 in.
Length over striking plates	67 ft. 11 in.
Length over end sills	67 ft.
Length inside, net	65 ft.
Width, overall	8 ft. 6⅛ in.
Width, inside	7 ft. 9 in.
Height, top of rail to top of car side	7 ft. 2¼ in.
Height, inside, floor to top of side	3 ft. 6 in.
Center to center of side bearings	4 ft. 2 in.
Center to center of trucks	56 ft. 9 in.
Wheel base of trucks	5 ft. 8 in.
Diameter of truck wheels	2 ft. 9 in.
Capacity, level full	1,763 cu. ft.
Capacity	140,000 lb.
Light weight	69,300 lb.

List of specialties applied to the Central of New Jersey 65-ft. gondola cars

Railroad	Central of New Jersey
Builder	Bethlehem Steel Co.
No. ordered	200
Angle cock holders	Burnett
Brake beams	Damascus
Brake-beam hangers	Schaefer
Brake-beam support	Buffalo
Brake equipment, air	Westinghouse, schedule KD-1012
Brake, hand	Ajax
Brake pins	Buffalo
Brake bottom connection	Schaefer
Brake shoes	American Brake Shoe & Foundry Co.
Bearings, journal	National Bearing Metals Corp.
Bearings, side	Miner
Car ends, steel	Hutchins
Couplers	National Malleable Steel Castings Co. (American Steel Foundries, Radial type)
Draft gear	Miner, A-22-XB
Draft-gear yoke	American Steel Foundries
Journal boxes	Birdsboro (Integral with side frame)
Journal-box lids	Allegheny Steel Co.
Nuts, except safety devices	Columbia
Paint, black	Sherwin-Williams
Paint, hull lead	Paterson-Sargent
Pipe fittings	Reading
Pipe unions	Corley
Pipe brake	Reading
Plates, steel	Copper bearing
Springs	Crucible Steel Co.
Springs friction coil	Frost Railway Supply Co.
Truck, bolsters	Birdsboro
Truck side frame, cast steel	Birdsboro
Uncoupling lever	Hutchins
Wheels, 850 lb. single plate cast iron, 100 cars	Reading Car Wheel Co.
Wheels, steel A.R.A. 100 cars	Bethlehem Steel Co.



Elevation and floor plan of the Central of New Jersey 65-ft. gondola car

angle under the center-sill cover plate. The floor splice plates are formed by the crossbearer cover plates. A 1¼-in. countersunk pipe plug is set flush in each floor panel and a ⅛-in. tapered drain hole is provided at each plug. These floor outlets are provided to drain the water from the car.

Draft Gear and Trucks

Miner friction draft gears, class A-22-XB, are used. The draft-gear keys are carbon steel forgings, quenched and tempered to conform to railroad standards, while the draft-gear back stop is of cast steel, cast integral with the bolster center filler. The couplers are Type D, with 6-in. by 8-in. shank and the American Steel Foundries radial-type cast-steel yoke.

The car superstructure is mounted on four-wheel trucks with 5-ft. 8-in. wheel base, using Birdsboro cast-steel side frames with integral journal boxes for 6-in. by 11-in. journals, Birdsboro cast-steel bolsters and 33-in. wheels.

The designs of these cars were developed by the mechanical department of the railroad. The general construction and appearance of these cars are shown in the illustration, side-elevation and cross-section drawings. The list of specialties and the principal dimensions are given in the tables.

Whitcomb Oil-Electric Switching Locomotives

(Continued from page 676)

castings, carrying three bars through from end to end. The bumpers also are steel castings of a size and weight required to give the specified weight on driving wheels. The underframes, carrying the engines and generators, act as cross-braces from one frame to the other, and one extra cross-brace is applied in the center of the frame to give additional rigidity. In fact, with this construction, it is entirely feasible to lift the locomotive off the rails by a locomotive crane, and hook attached to one bumper. This was demonstrated in the case of an accident in which the rails spread at a switch and allowed the locomotive to run on the ground. Under ordinary circumstances of this kind, however, the power of the locomotive and the fact that it has a rigid wheel base, makes it easy to run the locomotive back onto the rails under its own power.

Control of locomotive speed and the various electrical circuits is accomplished by the use of a Westinghouse electro-pneumatic control system. This consists of master controllers conveniently located in the cab at dual operating positions which operate unit switches and relays grouped together in a control cabinet located above each generator unit and which operate the engine throttle so as to vary the engine speed. Each generator acts as a series motor to start its engine when connected across the battery through its series starting field. The starting circuits are controlled by magnetic contactors which in turn are remotely operated from the controller.

The main generator also charges the battery at engine idling speeds. A protective relay prevents the closing of the charging circuits until the generator voltage reaches a predetermined value, thus preventing damage to the battery from excessive voltage.

Cut-out switches are supplied in both the control and the battery circuits, enabling the operator to close the battery circuit for testing purposes or to cut out any one of the four traction motors at will.

All indicator meters, gages, starting buttons, priming devices, control levers and brake valves are so located with respect to the engineman that all operations, such as cutting in or out of a power plant, control of the locomotive and air brakes, can be effected without leaving the engineman's seat. Duplication of all control apparatus and air brakes enables the crew to work from either side of the locomotive and yet be in full view of the engineman at all times.

Thorough ventilation of the cab and engine cooling is secured by a push-type fan which draws all air and exhaust fumes from the engine compartment, forcing it out through radiators mounted at the front of each unit. All gases from the engine exhaust are carried through stacks well above the roof of the cab.

The air brake schedule is the Westinghouse Type EL combined automatic and straight air with distributing valve located in the cab providing easy accessibility for cleaning or repairs. Air compressors are the Gardner-Denver type of 59-cu. ft. per min. capacity, belt driven from the power take-off at the front of each engine.

The brake riggings, furnished by the American Brake Company, are especially adapted for heavy-duty switching locomotives.

The fuel capacity is 400 gal., with tanks so located as to provide easy access for refilling and a capacity large enough to meet all the demands of the most severe service for a full 24-hr. period or longer.

The batteries for electrical engine starting, initial generator-field excitation, headlights, cab lights and control apparatus are of the Exide MVH type, having a 300-amp.-hr. capacity.

Sanders, of the latest Graham-White type, are designed to assure adequate sanding of the rails at all times when maximum adhesion is required. Pyle National headlights of standard railway design are used, one at each end of the unit. All steps, grab handles and other safety appliances are designed and built to conform with I. C. C. requirements.

Special Provision for Operation in Cold Weather

Another noteworthy feature of the Whitcomb locomotives is the Vapor self-contained heating plant, mounted within the cab and so arranged that ample heat is provided for the engineman during cold-weather operation. During layover periods, in freezing weather, warm water from the heater is allowed to circulate through radiators and cylinder blocks, eliminating the necessity of using an anti-freeze solution in the engine-cooling system.

To promote easy starting and insure instantaneous flow of warm oil, when starting, to all engine bearings, all crankcase oil is pumped back into a main supply tank which is kept heated from the hot-water heating unit and returned to the crankcase only as needed.

FIFTY YEARS AGO.—The committee on performance of locomotives of the American Railway Master Mechanics' Association [now Division V—Mechanical, American Railway Association], in its report at the annual meeting at Cleveland, Ohio, states that it is "of the opinion that the consolidation engine is destined to be the coming engine for heavy freight service. At a speed of not to exceed 12 miles per hour, it is best adapted, all things considered, for general freight service, while with a speed of not to exceed 15 miles per hour, the Mogul engine will give very good results. For fast freight and where a speed of 20 miles an hour is sometimes necessary, the American or eight-wheeled engines would no doubt be most economical."—Railroad Gazette, May 21, 1880.

Air Consumption of Sand Hoists

Most efficient rate of air flow for various size delivery pipes determined by Frisco tests

By S. H. Acker

Assistant Engineer of Tests, St. Louis-San Francisco

THE sand hoist, in common with some other devices used by the railroads, often suffers neglect because it is so dependable in service and simple in operation that little thought is given to its improvement. In fact, it is rather common practice to use compressed air for various purposes at terminals with little regard for the cost of the air or the quantities used. It is only when the capacity of the compressors is exceeded that a survey is made to determine where the demand can be cut down without imposing a handicap on working conditions.

In the particular case under discussion, an investigation of sand hoists was instituted to determine the size of compressor that should be installed at each of three outlying points on the St. Louis-San Francisco where there was no use for compressed air excepting to hoist sand for locomotives. It was desired to use the smallest compressor that could be depended on to do the work reliably.

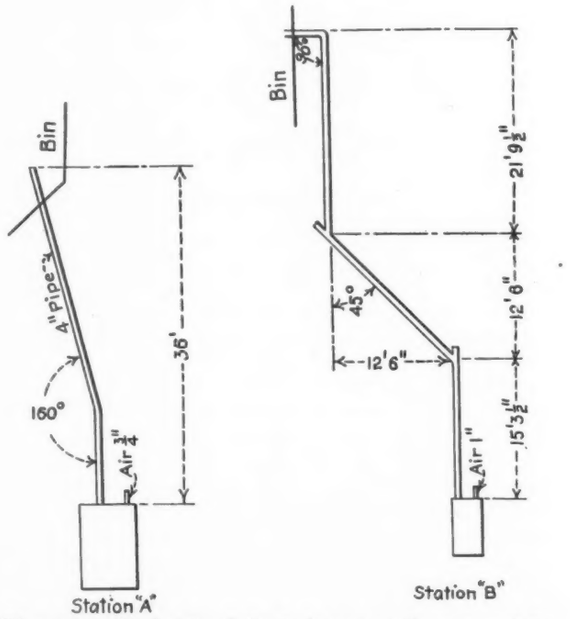
The pursuance of the investigation led to some interesting developments that led, not only to the solution of the immediate question, but to the development of general rules applying to installations already in use which resulted in a material saving of air. This saving was both in the total quantity of compressed air required to lift a given quantity of sand and in lowering the demand; that is, the cubic feet of free air per minute taken from the air supply lines. This saving was made by merely introducing chokes in the air supply line at negligible cost.

Typical Operation of Sand Hoist

The construction and operation of compressed-air operated sand hoists vary chiefly in detail; the essential principles remain the same. The sand is first dried and screened to separate the rock and foreign material, the screened sand falling into a hopper located under the screens. The sand is then allowed to flow from the hopper into the sand drum of the hoist proper. The sand valve in the top of the drum is closed when the drum is full and compressed air admitted through the air supply line. The air passes through the sand discharge line carrying the sand with it to the storage bin located at a convenient height to supply the locomotive sand domes by gravity.

Test Developments

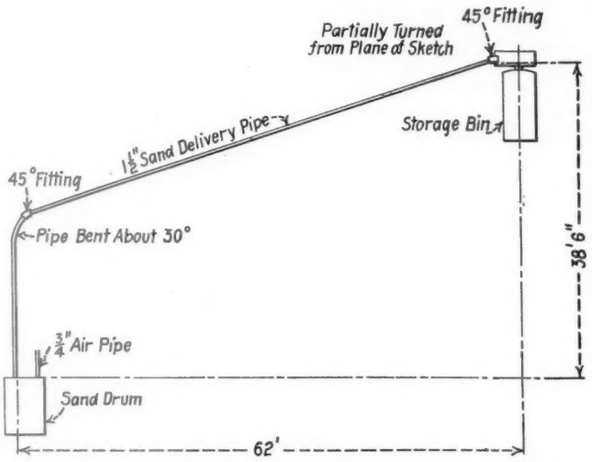
The points at which the sand hoists were tested will be referred to as stations A, B, and C. Originally the sand delivery pipe at station A was 4 in. in diameter. A 1¼-in. air supply line which lead to the sand house was reduced inside the house to a ¾-in. pipe 10 ft. long leading to the sand drum. An attempt was made to check the air consumption of this hoist with a 1-in. toolometer, but the flow of air was far greater than 100-cu. ft. of free air per minute, the capacity of the meter. A check was made by counting air compressor strokes when the load, with the exception of the sand hoist and leakage, was off the line. The volumetric efficiency was assumed to be 85 per cent and the leakage deducted from the theoretical amount of air used. The sand hoist was calculated to use 291 cu. ft. of free air per minute at about 100 lb. per sq. in. pressure. This consumption was greater than expected, so further tests were conducted with a 2-in. toolometer having a range of slightly over 300 cu. ft. of free air per minute. A 2½-in. pipe was substituted in the sand delivery line in the place of the 4-in. line on some of the tests in an attempt to reduce the air demand. This was but partially successful as it lowered the consumption from 320 cu. ft. of free air per minute to 283 cu. ft. On account of increased friction losses in the smaller pipe, the time required to lift a given quantity of sand was increased so that 365 cu. ft. of free air were required to lift 1 cu. yd. of sand where the 4-in. delivery line required but 301 cu. ft.



Diagrammatic sketch of the hoists at stations A and B, showing piping characteristics of each

It was then attempted to lower the demand for air by placing chokes in the air supply line. This was much more successful than decreasing the diameter of the sand delivery line. The use of chokes not only cut down the cubic feet of free air used per minute, but also cut down the total amount of air used to lift a given quan-

tity of sand. The various readings are given in the table recording the results of the tests at station A. A study of the readings shows that in general the restriction of the air supply not only decreased the rate of air



Diagrammatic sketch of the hoist at station C

flow, but also decreased the total quantity of air used to lift a given quantity of sand. Upon choking the flow of air in the air supply line with a ⅜-in. orifice, however, the total air required began to increase when using a 4-in. sand delivery pipe.

The investigations were pursued further by checking the air consumption of the sand hoist at station B. This hoist had two 45-deg. bends and one 90-deg. bend in the sand delivery line and carried the sand 13½ ft. higher than the hoist tested at station A. The discharge pipe for the sand hoist at station B was 3 in. as compared with the 4-in. and 2½-in. discharge pipes used at station A. The effect of the longer pipes and additional bends is reflected in the fact that it required more air to hoist a cubic yard of sand with the hoist at station B than at station A. The air supply line at station B was choked until the air flow was too weak to maintain the sand discharge and the pipes clogged. The results of the tests run at station B are shown in one of the tables. The number of cubic feet of free air per minute used at station B was maximum at the start of all tests where a ⅜-in. or larger choke was used. The average are the average of maximum and minimum readings.

The data gathered from the tests run at stations A and B were plotted, giving curves showing the cubic feet of free air per minute against the cubic feet of air required to lift a cubic yard of sand. These are shown in Fig. 1. An analysis of the results indicated that the quantity of air required to hoist a given quantity of sand at the most efficient rate would vary with the size of sand delivery pipe. Accordingly a check was desired of a sand hoist having a smaller sand delivery line.

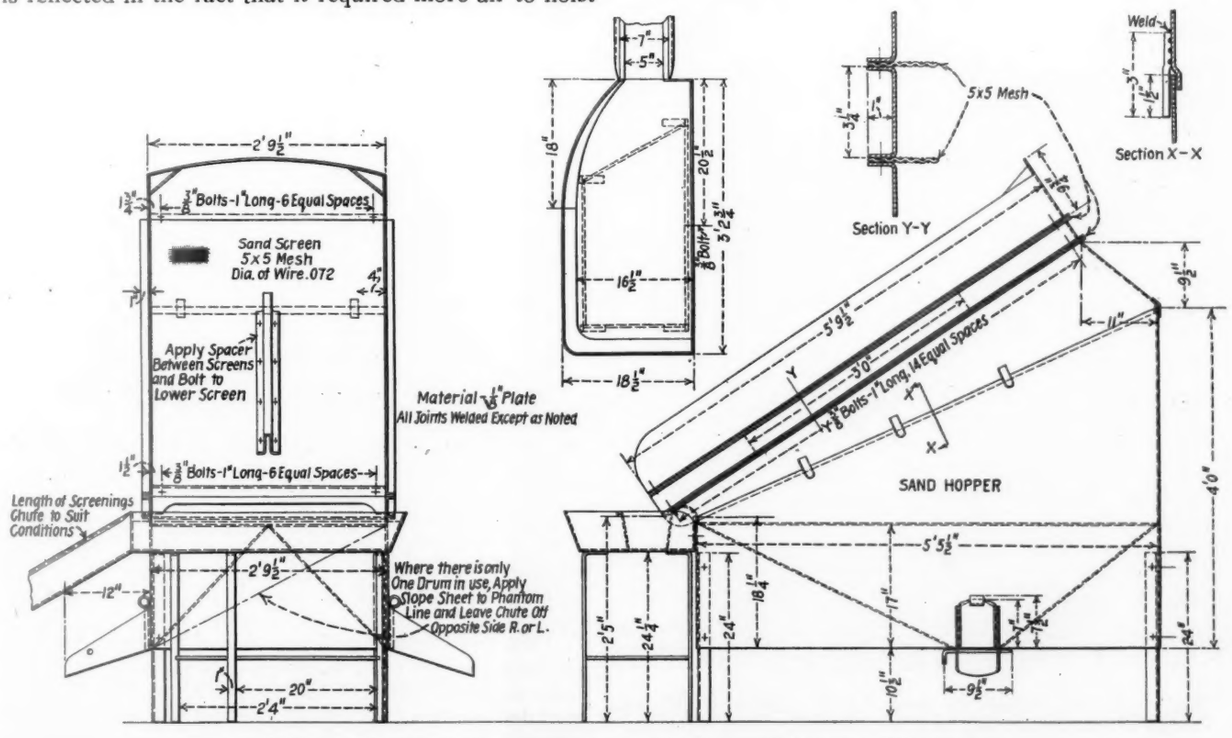
A hoist at a third station, designated as C, having a 1½-in. sand delivery line, was then selected for testing. The air supply line to the sandhouse was 1-in. in diameter but inside the house, leading to the drum, it was reduced to ¾-in.

On account of the large variation in air flow during

Cubic Feet of Air Per Cubic Yard of Sand Lifted in the Tests at Station A

Run	Cu. ft. air per min.	Cu. yd. sand	Time, sec.	Cu. ft. air per cu. yd. sand	Size sand pipe, in.	Size air pipe, in.	Size choke in air line
1	291*	.810	32	200	4	1¼—¾	None
2	320	.707	40	301	4	1¼—¾	None
3	283	.774	60	365	2½	1¼—¾	None
4	240	.732	60	328	2½	1¼—¾	½ in.
5	156	.732	75	267	2½	1¼—¾	⅜ in.
6†	146	.741	85	278	2½	1¼—¾	⅜ in.
7	148	.717	72	247	2½	1¼—¾	⅜ in.
8	221	.830	45	200	4	1¼—¾	½ in.
9	173	.790	55	201	4	1¼—¾	⅜ in.

* Calculated. The air flow was metered in all other tests.
† In run No. 6 the air supply was throttled down; on all other runs the valve was open.


2' 9½"
⅜" Bolts-1" Long-6 Equal Spaces
Sand Screen 5x5 Mesh Dia. of Wire .072
Apply Spacer Between Screens and Bolt to Lower Screen
Material ¼" Plate All Joints Welded Except as Noted
Length of Screenings Chute to Suit Conditions
Where there is only One Drum in use, Apply Slope Sheet to Phantom Line and Leave Chute Off Opposite Side R. or L.
20"
2' 4"
5x5 Mesh
Section Y-Y
Weld
Section X-X
SAND HOPPER
5' 5½"
5' 9½"
5' 0"
⅜" Bolts-1" Long, 14 Equal Spaces
4' 0"

The sand screen used in connection with the sand hoist at station A

the individual tests at the station C, it was necessary to plot curves in Fig. 2, showing the air flow with the different size chokes in the air line. It might be noted that the 1½-in. sand delivery line restricts the flow of air from the sand drum so that a pressure is built up in the drum that eventually equalizes the rate of air flow into the drum and up the sand delivery pipe.

Cubic Feet of Air Per Cubic Yard of Sand Lifted in the Tests at Station B

Run	Air pressure, lb. max.	Air pressure, lb. min.	Cu. ft. air per min. max.	Cu. ft. air per min. min.	Cu. ft. air per min. avg.	Cu. yd. sand lifted	Time, sec.	Cu. ft. air per cu. yd. sand	Size choke in air line, in.
1	90	90	257	237	247	.378	..	..	None
2	78	78	198	173	185	.378	40	326	None
3	92	90	293	227	260	.378	40	356	None
4	91	89	279	216	247	.378	31	338	None
5	75	75	194	146	170	.378	40	300	½
6	90	90	221	173	197	.378	40	348	½
7	98	98	166	148	157	.378	43	298	⅜
8	96	90	160	133	149	.378	43	283	⅜
9	97	97	82	82	82	.378	75	271	¼
10	100	100	82	82	82	.378	75	271	¼
11	100	100	46	46	46	.378	900	*	3/16
12	100	100	46	46	46	.290	240	634	3/16
13	112	105	34	34	34	None	900	..	⅛

* The last portion of sand is carried out of the drum at a very slow rate; run 12 which was stopped before all the sand was removed should be used for the 3/16-in. choke.

The average rate of air flow for the various size chokes used in the air line of station C was obtained by planimetering the area below the curves which were plotted from readings taken at 15 sec. intervals. The curve for the ¾-in. open pipe represents the first three runs shown in table recording the results of tests at station C. The curve for the ½-in. choke represents run 4, the curve for the ⅜-in. choke represents runs 5 and 6, and the curve for the 3/16-in. choke represents runs 7 and 8. Run number 9 was obtained by throttling the air flow down to a practically uniform rate with a valve in the air line.

Cubic Feet of Air Per Cubic Yard of Sand Lifted at Station C

Run	Air pressure, lb. max.	Air pressure, lb. min.	Cu. ft. air per min. max.	Cu. ft. air per min. min.	Cu. ft. air per min. avg.	Cu. yd. sand	Time min.	Time sec.	Cu. ft. air per cu. yd. sand	Size choke in air line, in.
1	78	40	152	44		.311	1	35		¾
2	82	50	154	48	79	.311	1	40	418	¾
3	82	48	163	45		.311	1	40		¾
4	85	40	151	49	79	.311	1	40	423	½
5	85	60	115	40	63	.311	1	45	380	⅜
6	82	55	118	40		.311	2	..		⅜
7	87	80	39	29	30	.311	4	..	370	3/16
8	85	78	41	29		.311	3	40		3/16
9	55	52	20	19	19.5	.311	6	40	418	Throttle

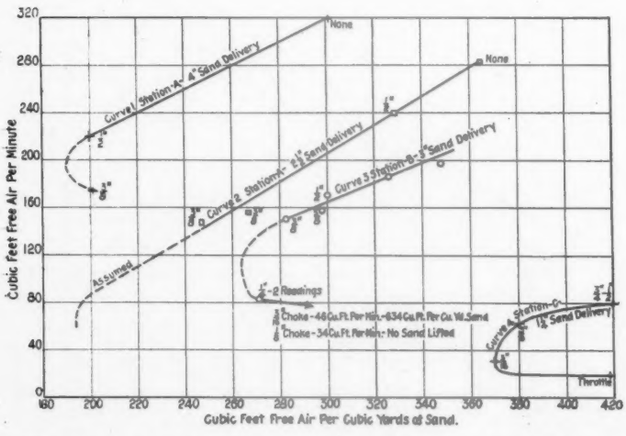

Curve 1 Station A-4" Sand Delivery
Curve 2 Station A-2½" Sand Delivery
Curve 3 Station B-3" Sand Delivery
Assumed
2 Readings
Choke - 46 Cu. Ft. Per Min. - 634 Cu. Ft. Per Cu. Yd. Sand
Choke - 34 Cu. Ft. Per Min. - No Sand Lifted
Curve 4 Station C-1½ Sand Delivery
Throttle
None
Cubic Feet Free Air Per Minute
Cubic Feet Free Air Per Cubic Yards of Sand.

Fig. 1—Curves plotted to show the air flow with different size chokes in the line and to obtain the most efficient rate of air flow required at each of the three stations

All attempts to lift sand with less than 19 cu. ft. of free air per minute resulted in the sand clogging the sand delivery pipe.

Analyses of the Test Data

An inspection of the curves in Fig. 1 shows that the most efficient rate of air supply at station C is about 27 cu. ft. of free air per minute. This gives a velocity of 2,200 ft. per min. in the 1½-in. sand delivery line. The curve for station B shows the most efficient rate of air consumption to be about 100 cu. ft. of free air per minute giving an air velocity of 2,015 ft. per min. up the sand delivery pipe. Similarly, at A, the hoist operated most efficiently with 190 cu. ft. of free air per minute, or a velocity of 2,170 ft. per min. up the sand delivery pipe.

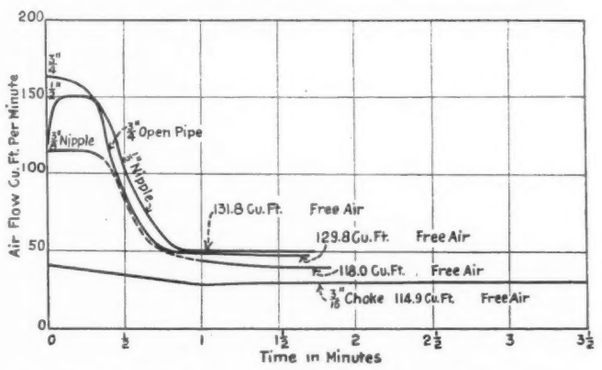

¾" Nipple
¾" Open Pipe
1" Nipple
131.8 Cu. Ft. Free Air
129.8 Cu. Ft. Free Air
118.0 Cu. Ft. Free Air
⅜" Choke 114.9 Cu. Ft. Free Air
Air Flow Cu. Ft. Per Minute
Time in Minutes

Fig. 2—Curves showing the rate of air flow at station C with various size chokes in the air supply line and amount of air to lift one drum of sand

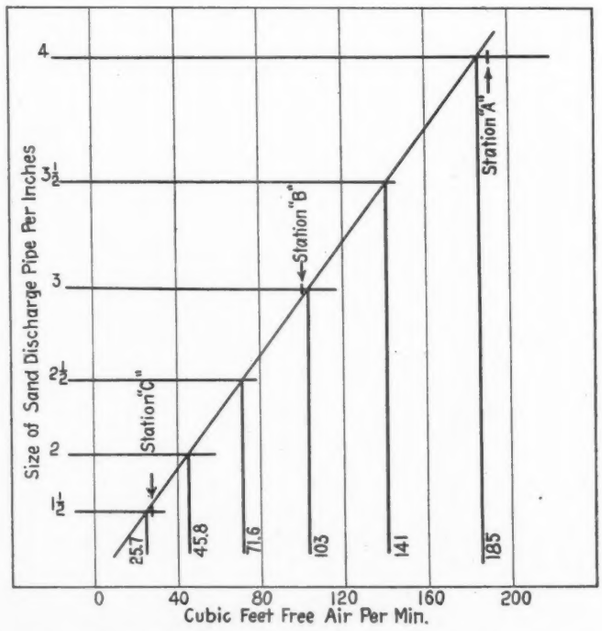


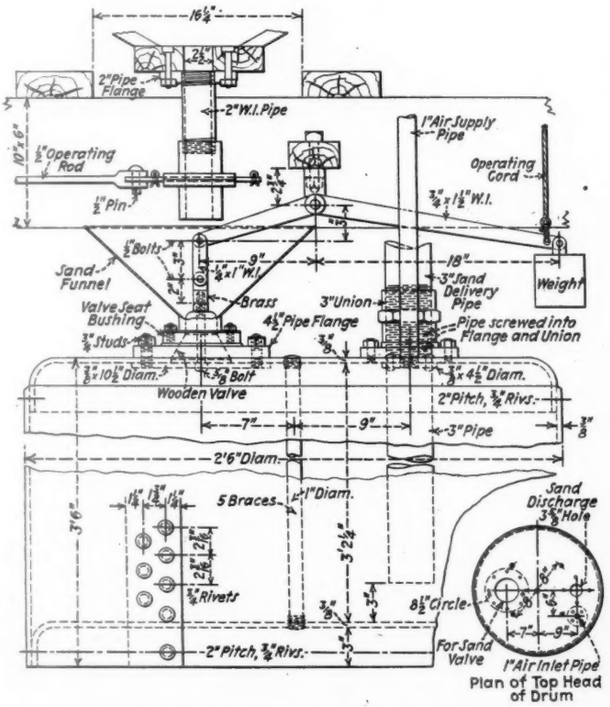
Fig. 3—Curves showing the demand in cubic feet per minute for different size sand-delivery pipes

The above figures will be affected to some extent by air leaks in the sand hoists, but it is something more than a coincidence that the most efficient velocity of air flow in the sand delivery pipe checks so closely on three different installations. It is logical to expect that a cer-

tain velocity of air flow will carry sand more efficiently than any other velocity, regardless of the design of hoist. This velocity is around 2,000 to 2,200 ft. per min. for the sands used during the tests, which should not vary appreciably for any dry locomotive sand.

The above velocity gives a method of checking sand delivery-pipe sizes with air demand under most efficient working conditions. The curves in Fig. 3 were drawn to show the air demand in cubic feet per minute for different size sand delivery lines. Caution should be exercised in applying this curve, since there is no factor of safety and, particularly with the smaller size pipes, a slight reduction of the air supply below the most efficient operating rate will cause the sand to clog in the sand delivery pipe and render the hoist inoperative.

A comparison of the two curves in Fig. 1 for the hoist



Details of the sand drum used at Station B

at station A shows that although a smaller sand delivery pipe requires a smaller rate of air supply, the total quantity of air required to lift a cubic yard of sand is greater for a small pipe than a larger one. A comparison of the curve for the hoist at station B with a 3-in. sand delivery line with the curve for the 2½-in. sand delivery line at station A shows that the more severe bends and the greater height of the hoist at station B resulted in a greater consumption of air to lift a given quantity of sand even though the sand delivery pipe was larger. In other words, the most efficient rate of air flow with a given size delivery pipe is the same for all installations, but the time required to lift the sand will vary with the amount of friction introduced in the sand delivery lines by length of pipe and bends. Also a larger sand delivery pipe will require a greater air flow than a smaller, but the time required to lift a unit quantity of sand will be less than to lift the same quantity with a smaller pipe installed in the same manner.

Conclusions

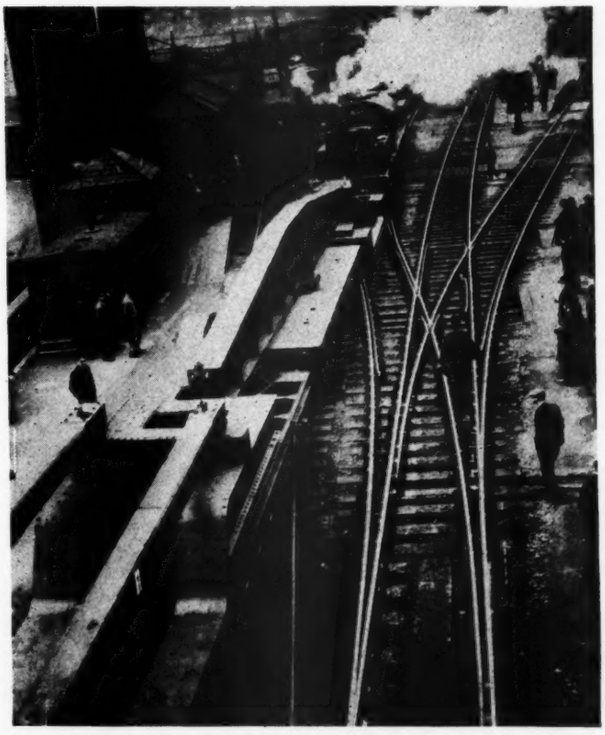
The air consumption of existing sand hoists, both rate of flow and total quantity, may be reduced by placing a ⅜-in. choke in the air line of a hoist employing a 4-in. and 3-in. sand delivery pipe, a ¼-in. choke in the air line of a hoist using 2-in. or 2½-in. delivery pipes and a 3/16-in. choke in the air line of a hoist with a 1½-in. delivery pipe. (The use of a ¼-in. choke will reduce appreciably the time required to hoist sand with a 1½-in. delivery line. This should be used when a saving of 5 min. per cu. yd. of sand warrants an increase in the total quantity of air used. The air is assumed to be 90 lb. gage pressure.)

Recommended Available Air Supply for Sand Hoists with Various Delivery Pipe Sizes

Sand delivery pipe	Cu. ft. of free air per min. Most efficient rate of air flow	Recommended available air supply
1½ in.	25.7	40
2 in.	45.8	60
2½ in.	71.6	75
3 in.	103	105
3½ in.	141	135
4 in.	185	180

For the purchase of compressors or calculations of cubic feet of free air per minute required to operate sand hoists with various sizes of delivery pipes, figures were tabulated showing the recommended available air supply. These figures are shown in one of the tables.

The reason for allowing a surplus of air for the smaller pipe sizes and not for the larger sizes, is that with the smaller delivery pipes a small decrease in the amount of air supplied, or a small increase in the amount of air lost through leakage will cause the hoist to fail, while the larger size delivery pipes will continue to function some time after the rate of air supply has been lowered beyond the most efficient point. Seventy pounds air pressure will be ample for the smaller hoists.



Keystone Photo

Great Britain's demonstration freight train entering Victoria Station, London

A. R. A. Billing

Compliance with Rule 4 prescribing use of defect and joint evidence cards would facilitate interchange of cars

FOLLOWING is an abstract of the report of the Committee on A.R.A. Billing, Car Department Officers' Association, which was presented during the meeting on car interchange rules at the convention of the association held at Detroit, August 26 to 28, inclusive,* by E. S. Swift (chairman), chief A.R.A. clerk, Wabash, Decatur, Ill. In presenting this report, the chairman emphasized that the answers to the questions are merely the opinion of the majority of the committee and are in no sense to be considered official until and if favorably acted on by the Arbitration Committee of the Mechanical Division, American Railway Association. The three letters pertaining to Rule 4, abstracts of which are included in this report were submitted by important trunk-line carriers and are published to develop further discussion. The report with a selected list of questions and answers follows:

Your committee circulated letters to all railroads and private lines inviting questions and recommendations on the rules which would clear up many disputes now being conducted between various roads. It has been our intention to give our opinions on billing matters and recommend changes, which we felt would reduce to a minimum the cost of correspondence over car repair-bills.

The response to these circular letters far surpassed our expectations, and the questions asked indicate clearly that there is room for advancement in the billing rules, and a field of opportunity for this committee.

[A list of questions selected from those submitted to the committee, together with answers which we submit for your approval, follows —EDITOR.]

Question—Rule 66: Does the car to be repacked,

*Reports of the second annual convention of the Car Department Officers' Association were published in the *Railway Mechanical Engineer* for September, 1930, page 503, and October, 1930, page 561.

Better Protection for Defect Cards

CHICAGO.

TO THE COMMITTEE:

I am convinced that the interchange of equipment would be facilitated and greater accuracy prevail in the issuance of defect cards at interchange points, if there was an honest and general effort made by all concerned in the application of A.R.A. Rule 4, first paragraph.

My personal attention has been called to many cars bearing apparent delivering-line damage, brought about on account of cornering, side swiping, or derailment, and in many instances partial repairs (particularly repairs to safety appliances) have been made, with no card on the car to cover delivering-line damage not repaired. It is true that there is no way of telling when or where this damage occurred, and I feel safe in saying that 75 per cent of the defect cards issued at interchange points are not issued against the line responsible for the damage. It is evident that no effort is being made to protect this damaged equipment at points where damage occurs, or, if such cars were properly protected, then it is apparent that the cards have become lost off the cars.

Treating with this question of lost cards, I am convinced that the time is at hand when some arrangement must be made to protect defect cards, and that a receptacle of some kind should be devised and applied to all equipment, for the proper protection of defect cards, which under present conditions are being either removed or lost off enroute, due to the manner in which we are forced to apply them.

REPRESENTATIVE OF ROAD A.

after the 12-month period has expired, have to be shopped for some other defect before the journal boxes can be repacked, or could a car in the transportation yard, previous packing date "over date" but OK otherwise be shopped on the "over date" account alone, and boxes be repacked? *Answer*—If the old date is over 12 months, or the car bears no date of last packing, the car can be shopped for the packing of the boxes, regardless of any other defects.

Question—Can any additional charge be made for rivets securing safety appliance, etc., to the tanks of tank cars outside of the charge allowed for rivets in Items 439, 440, and 441 of Rule 107? *Answer*—Labor charge for renewing safety appliances riveted to tanks of tank cars should be charged at the rate provided in Item 443 of Rule 107. Material in rivets to be charged on weight basis.

Question—Can the material charge for a second hand brake beam and labor for renewal and repair of the same be made when the beam is removed and replaced to apply a truss rod nut 1⅜ in. or under? *Answer*—Charge for the application of a truss-rod nut to a beam, where the beam is renewed and repaired, should be in accordance with the material allowance for a second-hand beam of the type required, plus labor as provided by Item 45 of Rule 107.

Question—What is the proper labor charge for the application of a brake top rod when the car is jacked for other repairs? *Answer*—The labor charge to be made for one connection pin. The jacking of car includes the repairing and renewing of one pin.

Question—In making repairs to a refrigerator car on authority of a defect card, is the owner justified in charging 2 cents per pound for galvanizing the sill step, and grab iron, also bolts which secure the same to the car? *Answer*—The A.R.A. allowance for wrought iron will include the cost of galvanizing or any other special process necessary for such material.

Question—Is a wooden dead block, properly framed with new lumber, drilled and plated with a striking plate and applied in a workmanlike manner, in place of a broken metal striking casting, an owner's defect or wrong or temporary repairs? *Answer*—Where the work is performed in a substantial manner it should be considered wrong repairs and properly billable against the owners, the repairing line to attach its defect card for "labor only" to the car.

Question—Effective August 1, 1929, car owners are entitled to protection on a basis of wrong repairs for the removal of wheels on account of being out of gage or for oil seepage, provided the wheel is removed within one year from the date of application. Does this rule provide protection to an owner where the wheel is applied prior to August 1, but removed subsequent to August 1, if within one year? *Answer*—If a wheel is removed on account of these defects subsequent to August 1, the owner is entitled to the protection provided, if the wheels were applied within one year.

Question—A broken 5-in. by 5-in. by 8½-in. coupler, standard to the car is removed, on account the owner's defects, and a new 5-in. by 7-in. by 8½-in. type D coupler, is applied. Should the charge be for labor and the value of the type D coupler or labor and value of a new 5-in. by 5-in. coupler, or should the coupler applied be considered as scrap and no charge made for labor or material, the car owner having claimed wrong repairs? *Answer*—If the repairs made were neither standard to the car nor A.R.A. standard, wrong repairs were made provided the car did not have a clearance for a 7-in. shank. If a defect card was not applied to the car at the time repairs were made, adjustment should be made in line with Interpretation 4 to Rule 87 and Interpretation 15 to Rule 17.

Question—A tank-car crown sheet weighing 4,370 lb. is removed, repaired and replaced. What is the proper manner of charging the labor for this work? *Answer*—Labor for removing and replacing the tank sheet should be actual labor at the rate provided in Item 443, Rule 107. The labor for repairing should be 4,370 lb. at $1.90 per hundred as per Item 441, Rule 107. Material only of rivets to be charged.

Question—A new 80M axle and new wheels are applied to road *A* car June 11, 1928 by road *B* and are removed by road *C*, February 21, 1929, the repair card showing axle removed as having a 6 7/16-in. wheel seat. Does the repair card of road *C* act as a joint evidence under Rule 90 that road *B* applied a second-hand instead of a new axle, and if so should road *B* refund the full amount for the difference between a new and second-hand axle or 50 per cent and road *C* refund 50 per cent? *Answer*—If the car was not on the owner's rails between the dates that the axle was applied and removed, the repair card acts as a joint evidence under Rule 90 and road *B* should refund the full amount of the charge for the difference between the new and second-hand axle. The 50 per cent clause only affects axles removed with long journals.

Question—Referring to Item 160, Rule 107. Single-sheated box cars are equipped with a back door stop which is bolted through a block which sets the stop out from the posts. The same bolts fasten both the door stop and block to the car. Where both of these items are removed at the same time should 2 hr. be charged for each or should .2 hr. cover both items? *Answer*—The .2 hr. Item 160, Rule 107 covers labor for each item when renewed at the same time.

Question—Referring to Item 202-B, Rule 107. Does the labor charge of 4 cents per foot for the application of nailed fascia include the repair and renewal of corner iron bolts or the repair and renewal of roof flashing, which must necessarily be removed to apply the fascia? *Answer*—The labor of renewing fascia Item 202-B, Rule 107, does not include the labor for repairing and renewing of corner iron bolts or roof flashing.

Question—Under Rules 101 and 107, effective January 1, 1930, what is the proper charge for the application of a 5-in. by 9-in. journal bearing? *Answer*—Material $1.77, labor 7/10 hr.

Question—With reference to Rule 91, repair cards with wrong number. Should not the repairing line furnish a correction or counterbilling authority for failure to do so, subsequent to the bill being passed for payment, regardless of the amount of the exceptions? *Answer*—If the total amount of exceptions, which include wrong numbers and exceptions, do not amount to $1.00 in aggregate, no exceptions should be taken under Rule 91. A bill should in such case be passed for pay-

Intent of Rule 4 Not Observed

CHICAGO.

TO THE COMMITTEE:

If the provisions of the first paragraph of Rule 4 were complied with, a large amount of our present troubles resulting from misplaced responsibility at interchange points would be practically eliminated.

I appreciate that more defect cards are being issued by handling lines for damage developing while equipment is in their possession than ever before. Apparently this carding is done where damaged cars reach repair tracks of the damaging line, but many cars are being damaged to the extent that defect cards are in order, under the provisions of the interchange rules, which do not reach repair tracks. It is apparent that defect carding at the first available point on a handling line, as provided for in Rule 4, is simply not being done, and apparently little effort is made to enforce the provisions of the rule. While it may be true that all concerned have been properly informed as to the intent and purpose of the rule, it is apparent that very few, if any, railroads are following the practice of enforcement to the end intended.

The present interchange rules are favorable to the car owner who desires to maintain a high standard of maintenance, but, with few exceptions, equipment is not maintained to the standards required in accordance with the A.R.A. rules. To the contrary, it seems to be the general practice to permit equipment with defects which should be repaired to remain in service until such time as cars go through the shop for class or general repairs, in preference to shopping cars and making immediate repairs. Particularly is this true of steel equipment which can be and actually is permitted to remain in service with damaged parts that are practically destroyed. For example, thousands of steel hopper and gondola cars are moving in service throughout the country with metal side stakes cut through to the side sheets, body-bolster webs and cover plates cut by wheels, underframes distorted, and other similar damaged conditions, which are apparent to those who observe.

The judgment used by the inspectors is, to a great extent, based on the policy of the company employing them.

REPRESENTATIVE OF ROAD B.

ment before exceptions are taken.

Question—The 1930 A.R.A. Rules state where a car bears a previous stencil for an old-style coupler, this stencil must be changed when an A.R.A. type D coupler is applied. When a repairing road fails to change the stencilling in such case what overcharge can the owner demand? *Answer*—A counterbilling authority should be furnished the owner for the difference between the common and type D coupler.

Question—Is there not a conflict between the first and second paragraphs of Interpretations 4, Rule 87, Supplement No. 1, effective August 1, 1929? *Answer*—No. The first paragraph refers to the repairing road, making it optional as to whether it applies a defect card for wrong repairs or marks the repairs card "No Bill." The second paragraph refers to the owning road and makes it optional as to whether it requests a cancellation of the charges or not.

Question—Is it necessary to show on a billing-repair card what a car is shopped for when the journal boxes are repacked, in cases where the old date is over one year or the car bears no previous date of packing? *Answer*—No.

Question—Interpretation No. 22, Rule 17, 1929 Rules, has been omitted from 1930 rules. Is this interpretation still effective after January 1, 1930? *Answer*—Yes. This same ruling has been inserted in Rule 104, fourth paragraph on page 148.

Question—Under Rule 104, can a charge be made for a second-hand beam and labor of one hour for the application of a 1⅛-in. truss rod nut where the beam is removed to perform this work? *Answer*—Yes.

Question—A car received in interchange with a chipped rim wheel is carded to the repair track for repairs as an owner's defects. While switching to the repair track, the car is derailed on account of the chipped rim. Does Rule 32, Section A prohibit a charge against the owner for wheels? *Answer*—Yes.

Question—Under Rule 81, what adjustment can a car owner request where wheels have been removed for oil seepage or on account of being loose within one year from the date of application? *Answer* — Counterbilling authority should be furnished for the expense of correcting wrong repairs.

Question—What is the proper charge and credit for a plain-handle angle cock applied on an S. L. angle cock removed on account of being defective? *Answer*—No charge is made for the angle cock applied and $1.50 credit is made for the angle cock removed.

Question — A 60M-capacity axle is applied by a foreign line with a 5 9/16-in. wheel seat. This axle is removed by another road 11 months later, on account of a cut journal. A card showing the wheel seat to be 5⅜-in. or scrap is made out and a charge is made against the owner. What protection has the owner in such cases? *Answer*—The repair card of second road serves as joint evidence under Rule 90, providing the car was not on the owner's rails between the two dates. The road applying the axles must furnish a counterbilling authority for the charge made against the owner for the axle.

Question—Under Rule 60 where air brakes are cleaned twice within 60 days and a second card is used as joint evidence, what time limit has the owner to take such exceptions? *Answer*—The same time limit as joint evidence cards, 16 months.

Question—What is the proper manner for charging for the application of Simplex truck bolsters to foreign cars? *Answer*—Simplex truck bolsters are not considered manufactured articles and charge should be rendered on a weight basis as per Rule 101.

Question—Where a standard arch bar and bolts are applied per Rule 26 and the repairing line fails to apply nut locks, what adjustment should be made with the car owners? *Answer*—Counterbilling authority to be furnished for the value of the nut locks in excess of 1⅜ in. plus labor for repair and renewal of the box and column bolts and labor for jacking.

Question—Is it permissible to make a charge for jacking where it is necessary to raise a car to apply draft casting rivets or other items applied on a rivet basis, not specifically covered by the rules? *Answer*—Charge can be made for jacking only where the item specifies.

Question—What is the proper labor charge for a cylinder gasket renewed in connection with either a cylinder or reservoir renewal. Item 29, Rule 111 not involved? *Answer*—No labor charge for cylinder gasket in such cases.

Question—Should a table of weights for flat-rolled iron bars be used for determining weights of pressed or structural steel parts? *Answer*—No. Use actual scale weights.

Question—What is the proper labor charge for sections of cross ties, size approximately 4 in. by 9 in. by 4 ft. 6 in. where standard to the car? *Answer*—In view of no specified labor charge for such repairs, Item 433 of Rule 107 should be charged.

Question—What is the proper manner of charging for the removal of a 60M capacity axle on authority of a defect card for a cut journal when the axle is also scrapped on account of a low wheel seat or center? *Answer*—Labor, brass, bolts, etc., to be charged against the company issuing the defect card. Material charge of axle to be charged against the owner. See Section B, Rule 86, also Interpretation 1 to Rule 86.

Question—A car is shopped for repairs to damage caused by a derailment to the A end of the car only. The B end was not derailed. After receipt on the repair track, the foreman discovers a chipped rim wheel at the B end. Should the cost of changing such wheel be assumed by the repairing line or by the owner? *Answer* — Cost of changing wheels should be assumed by the repairing road.

Question—A car is shopped for a broken bottom arch bar, owner's responsibility, top bar and tie bar O. K. The repairing line changed both the top and bottom bars to agree with the requirements of Rule 26. Can the owner be charged with the cost of bars which are not defective? *Answer* — Charge against the owner should be confined to the defective bar.

Question—What is the proper labor charge for applying a vertical coupler key, it not being necessary to repair and renew the gear or coupler? *Answer*—In view of no specified charge in the A.R.A. Rules, actual labor should be charged.

Question — When multiple-wear wrought steel wheels, not full-flange contour, are applied and multiple-wear wrought steel wheels removed are scrap, is the car owner entitled to credit for turning? *Answer*—No.

Question—When wrong repairs are made, for example: If 2¾-in. decking is applied in place of 2⅜-in. standard to a car, is the car owner justified in requiring the repairing road to confine its charges to owner's standard, without use of joint evidence? *Answer*—Yes. Where the repair records show this information.

Question—Who is responsible for axles with wheel seats below the scrapping limit, removed account of a cut journal or slid flat wheels? *Answer* — The owner is responsible for 60M-capacity axles having a small wheel seat with a cut journal. The handling line is responsible

(Continued on page 695)

Honest Compliance with Rule 4 Needed

CHICAGO.

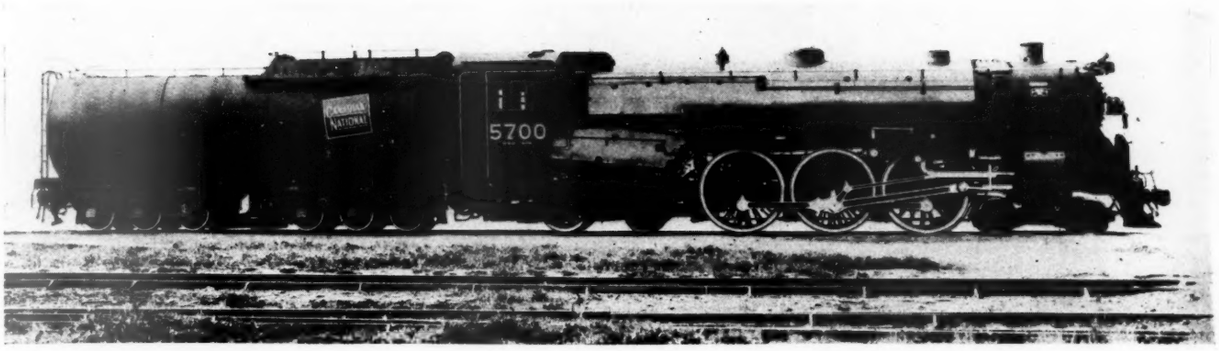
TO THE COMMITTEE:

The rules have probably progressed as far as practical with the times, in order to meet the wishes of the majority of the members. I fully realize it would be practically impossible for the framers of the rules to give a clear interpretation that would not be misconstrued in some form or other.

As an illustration, and referring particularly to A.R.A. Interchange Rule 4, I know of no other rule about which so much discussion has followed, relative to its proper interpretation and application. This rule has been somewhat modified in order to bring about a better understanding, and yet there seems to be some who apparently do not understand its provisions, or who willfully violate its provisions. The only trouble experienced with this rule is that the handling line does not exercise due diligence in its application, by issuance of its defect cards for damage sustained on its lines. Unfortunately it has been the practice of most railroads to apply more critical examination of equipment tendered them by connecting lines than on deliveries to their neighbors. From this standpoint, you can draw the conclusion that greater expenditures are made for inspection on receipt than on delivery. In other words, if conditions were equal, little trouble would be experienced, and responsibility would be fully covered.

From observation, I am convinced that little, if any, effort is being made properly to protect damage occurring on the handling line and prior to the tendering of equipment in interchange. It appears that the remedy for the present conditions at interchange points is in our hands, if we will make an honest effort to comply with the provisions of present Rule 4.

REPRESENTATIVE OF ROAD C.



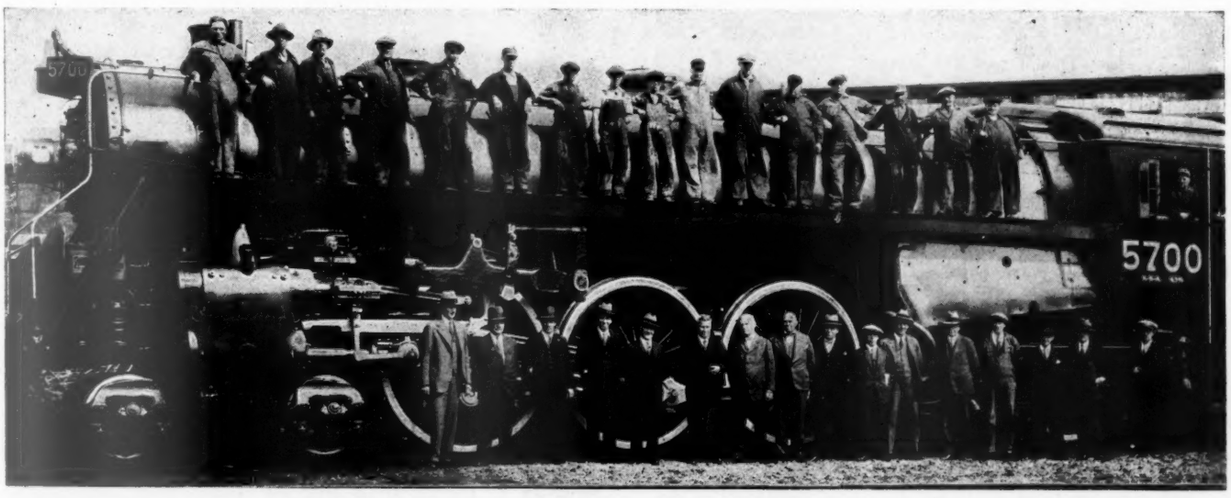
Canadian National 4-6-4 type locomotive built by the Montreal Locomotive Works, Ltd.

Five 4-6-4 Type Locomotives for the Canadian National

Designed for fast passenger service—Special attention given to producing attractive appearance

FIVE 4-6-4 type locomotives were recently placed in service by the Canadian National on its "International Limited" between Montreal, Que., and Chicago. These locomotives, which were built by the Montreal Locomotive Works, Ltd., were especially designed to present an attractive appearance. Practically all of the piping, especially that above the running board, is concealed beneath the jacket of the boiler. The jacket is of polished steel, while the other parts of the locomotive are finished in black Duco. The hand rails, which extend along the sides of the boiler from the cab to the front bumper, are of stainless steel. The air compressor, headlight generator, and piping under the smokebox are concealed by a vertical plate. The sand box is not located in its customary place on top of the boiler, but has been placed inside the smokebox.

The new locomotives exert a maximum rated tractive force of 43,300 lb., which, with the tractive force of a Franklin trailing-truck booster of 10,100 lb., gives a tractive force at starting of 53,400 lb. The cylinders are 23 in. in diameter by 28 in. stroke. The boilers operate at a pressure of 275 lb. The driving wheels are 80 in. in



Group of railroad officers and officers and workmen of the Montreal Locomotive Works, Ltd.

Included in the group are C. E. Brooks, Chief of Motive Power, Canadian National; H. C. Butler, Manager, Montreal Locomotive Works; J. D. Scott, Vice President, Holden Company, Ltd.; J. D. McGillis, Shop Superintendent, Montreal Locomotive Works; E. Sanne, Chief Draftsman and E. Parker, Erecting Shop Foreman, Montreal Locomotive Works; J. W. Johnston, Chief Inspector of Headlight and Car Lighting Equipment; W. H. Clegg, Chief Inspector, Air Brakes and Car Heating Equipment; J. W. Elliot, his assistant, and M. V. Milton, Chief Boiler Inspector, Canadian National.

diameter. The factor of adhesion of the engine is 4.35 and for the booster, 5.69.

The design of the new Canadian National locomotives follows lines which have been established as sound practice in the construction of locomotives intended for high-speed passenger service. The boiler is of conical construction of ample proportions having an inside diameter at the first course of 78 in. and an outside diameter at the largest course of 86 in. It is supported on a bed casting in which the front bumper, rear frame cradle, cylinders, feed-water-heater bracket and air reservoirs have been cast integral. An Elesco exhaust-steam injector is located on the left side of the locomotive, while a non-lifting injector is provided on the right side. Cut-off control gages are provided. The locomotives are equipped with steam whistles pneumatically operated from a valve in the cab. The firebox is 126⅛ in. long by 84 3/16 in. wide and contains two thermic syphons.

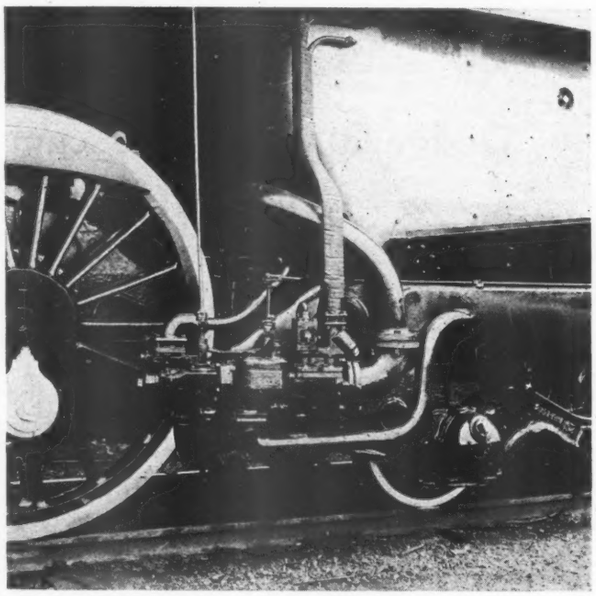
The main rods are of hammered nickel steel, fluted and fitted at the big end with floating bushings of nickel iron. The grease plugs are forged directly on the rods. the small ends of the main rods are fitted to allow grease lubrication through the wrist pins. The Alemite system of grease lubrication is applied whenever grease lubrication is required and includes motion work, spring rigging, knuckle pins, shoes and wedges, wheel hubs, brake-hanger pins, tender- and engine-truck swing bolsters, hanger pins and equalizer pins. Alemite fittings are also applied to the grease cups on the main and intermediate side-rod connections having extension bushings.

The engine trucks are of the four-wheel outside-bearing type with floating-bushing brasses and nickel-iron solid bushings pressed in. This design is applied to three of the locomotives and is interchangeable with engine trucks on the Canadian National 6100 class 4-8-4 type locomotives. The engine trucks on the two remaining locomotives are of Commonwealth inside-bearing construction equipped with SKF roller bearings. All five trucks have the Economy constant-resistance lateral-motion device. The engine trucks equipped with roller bearings have 33-in. diameter wheels, while the trucks of Canadian National bearing design are equipped with 34¼ in. diameter wheels. The former have an 86-in wheel base, while the latter have a wheel base of 82 in. The trailing truck is of the Delta four-wheel constant-resistant type, the rear wheels of which are equipped with a Franklin booster. The trailing-truck journal boxes and bearings are of the floating-bushing Canadian National standard design. The bearings are of hard bronze with nickel-iron stationary bushings.

The cabs are of welded construction throughout.

Table of dimensions, weights and proportions of the Canadian National 4-6-4 type locomotives

Railroad	Canadian National
Builders	Montreal Locomotive Works, Ltd.
No. ordered	Five
Service	Passenger
Cylinders, diameter and stroke	23 in. by 28 in.
Valve gear, type	Baker
Valves, piston type, size	12 in.
Maximum travel	9 in.
Steam lap	1⅞ in.
Exhaust clearance	¼ in.
Lead in full gear	¼ in.
Weights in working order:	
On drivers	188,600 lb.
On front truck	66,000 lb.
On trailing truck, front	44,300 lb.
On trailing truck, rear	57,500 lb.
Total engine	356,400 lb.
Total tender	305,800 lb.
Total engine and tender	662,200 lb.
Wheel bases:	
Driving	14 ft.
Total engine	40 ft. 2 in.
Total engine and tender	79 ft. 4⅝ in.
Wheels, diameter outside tires:	
Driving	80 in.
Front truck, C.-N. design	34¼ in.
Front truck, roller bearing	33 in.
Trailing truck, front	34¼ in.
Trailing truck, rear	48 in.
Journals, diameter and length:	
Driving, main	12 in. by 13 in.
Driving, others	11½ in. by 13 in.
Front truck	7 in. by 10 in.
Trailing truck, front	7 in. by 12 in.
Trailing truck, rear	9 in. by 14 in.
Boiler:	
Type	Conical
Steam pressure	275 lb.
Fuel, kind	Bituminous
Diameter, first ring, inside	78 in.
Firebox, length and width	126⅛ in. by 84 3/16 in.
Combustion chamber, length	30 in.
Tubes, number and dia.	44—2¼ in.
Flues, number and dia.	146—3½ in.
Length over tube sheets	19 ft. 1 in.
Grate area	73.6 sq. ft.
Heating surfaces:	
Firebox and combustion chamber	253 sq. ft.
Arch tubes	15 sq. ft.
Syphons	77 sq. ft.
Tubes and flues	3,032 sq. ft.
Total evaporative	3,377 sq. ft.
Superheating	1,492 sq. ft.
Comb. evap. and superheat	4,869 sq. ft.
Tender:	
Style	Vanderbilt
Water capacity	14,000 Imp. gal. (16,800 U. S. gal.)
Fuel capacity	20 tons
General data, estimated:	
Rated tractive force, 85 per cent, engine	43,300 lb.
Rated tractive force, booster	10,100 lb.
Total starting tractive force	53,400 lb.
Weight proportions:	
Weight in drivers ÷ total weight engine, per cent	52.8
Weight on drivers ÷ tractive force	4.35
Total weight engine ÷ comb, heat, surface	74.8
Boiler proportions:	
Tractive force, engine ÷ comb, heat, surface	8.89
Tractive force, engine × dia. drivers ÷ comb. heat. surface	710
Firebox heat, surface ÷ grate area	4.68
Firebox heat. surface, per cent of evap. heat. surface	10.22
Superheat. surface, per cent of evap. heat. surface	44.4



Application of the exhaust-steam injector

Tenders Have Unit Brake-Rigging Arrangement

A number of interesting features have been included in the design of the tender. It has a capacity for 20 tons of coal, and 14,000 Imp. gal (16,800 U. S. gal), which capacity is larger than that of any tender previously built for the Canadian National. It has a Commonwealth water-bottom frame and is carried on six-wheel trucks, the journals of which have Timken roller bearings. The tender tank has three filling holes to facil-

itate making water stops. A device for sprinkling the road bed to lay the dust is secured underneath the tender between the two trucks. It is operated by a control lever located in the cab.

The unit brake-cylinder arrangement applied to the tender is of unusual interest. This arrangement, which

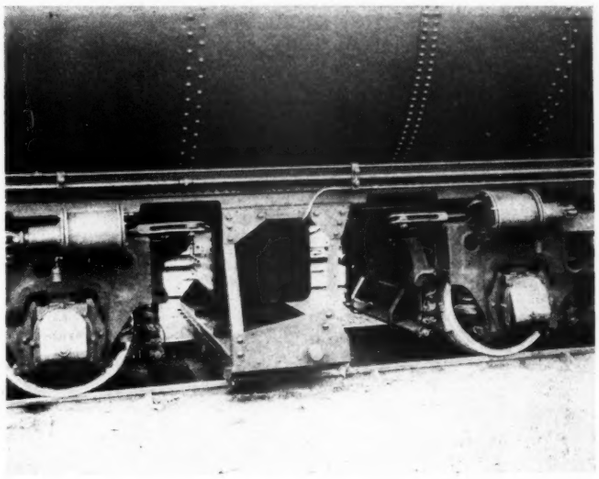
List of special equipment applied on the Canadian National 4-6-4 type locomotives

Railroad	Canadian National
Builder	Montreal Locomotive Works, Ltd.
No. ordered	Five
Service	Passenger
Boiler:	
Whistle	Viloco, air-operated
Firebox steel	Lukens acid
Firedoor	Franklin
Gage, cut-off control	Ashcroft
Gage, cut-off control	McAvity Co.
Grates	Hulson
Staybolt steel, rigid	Brown-Bayley-Longstrand
Steam pipe casing	Fetters Flextite
Stoker	Standard BK
Superheater	Type E
Syphons	Locomotive Firebox Co.
Throttle	American Multiple
Washout plugs	Huron
Frames and Running Gear:	
Axle, driving	Peach & Tozer
Bearings, inside, engine truck (3)	SKF
Boosters, trailer truck	Franklin
Bushings, cylinder and valve chest	Nickel cast iron
Castings, bed	General Steel Castings Corp.
Joints, flexible	Barco
Lubrication, rod	Alemite
Reverse gear	Franklin Precision
Rings, piston, bull and valve packing	Nickel iron
Rods, main and side	Nickel steel
Tires	Railway Steel Spring
Trucks, engine (3)	Commonwealth, inside bearing
Trucks, engine (2)	Canadian National, outside bearing
Trucks, Trailing	Commonwealth
Valve gear	Baker
Miscellaneous:	
Bell ringer	Lyman Tube & Supply Co.
Drawbar	Unit safety
Foot warmers	Elesco
Grease cellars	Franklin
Handrails	Stainless steel
Headlight	Pyle-National
Lubricators	Detroit
Steam heat	Vapor
Tender:	
Frame	Commonwealth, water bottom
Trucks (2)	Commonwealth, SKF roller bearing
Trucks (3)	Commonwealth, Timkin roller bearing

was developed by the mechanical department of the Canadian National, with the co-operation of the American Steel Foundries. This design provides for an automatic slack adjuster at each lever fulcrum at the end of the truck frame. Its application to the tenders of the Canadian National 4-6-4 type locomotives was because the braking ratio desired was beyond the capacity of a single 18-in cylinder, and the space beneath the tender and between the trucks was so limited as to preclude the practicability of using two 14-in. or two 16-in. brake cylinders. A single- or double-cylinder application, of correct size, would have necessitated foundation-brake parts of large size, which would have compelled the designers to employ undesirable dimensions and shapes and thus materially increase the frictional resistance to their movement and thereby affect the efficiency of the brake rigging.

The unit brake-cylinder arrangement, which provides for four brake cylinders, each of which are attached to the inside ends of the truck frames as shown in several of the illustrations, was adopted. Each cylinder operates the clasp brakes on one side of a truck. The application of the brake cylinders to the truck frame eliminated the tendency to pull the trucks off center, as sometimes occurs when the cylinder is attached to the tender frame. With respect to maintenance at engine terminals, brake adjustments on each side of the trucks can be made conveniently without the workmen going between or under the trucks.

The designers consider the application of flexible pipe



Sprinkler and brake-cylinder application on the tender

connections between the body of the tender and the truck to be in the experimental stage. However, based on the satisfactory service over a period of years of similar pipe connections between engines and tenders and to engine-truck brake cylinders, no trouble is expected from this source.

A. R. A. Billing

(*Continued from page 692*)

on all other capacity axles. Owners are responsible for all capacity axles having small wheel seats with cut journals.

Question—Who is responsible for an axle removed with a small center on account of a cut journal? *Answer*—Owners are responsible for axles of 60M capacity. The handling line is responsible for all other capacities.

Question—Is the charge allowed for bolsters under Item 188B of Rule 101 intended to include material for the center plate, side bearings and rivets? When such bolsters are broken what credit should be allowed for the center plate and side bearings if O.K.? *Answer*—Item 188B, Rule 101, includes center plates, side bearings and rivets. Such items when removed with a broken bolster should be credited as scrap.

Question—A car is delivered to the owner defect carded for a cut journal. What charge can the owner make for application of new wheels and axle. Old wheels O.K.? *Answer*—Charge for wheels must be confined to second hand. If the axle was scrap on account of the cut journal, charge can be made against the defect card for the new axle, less scrap credit. If the axle was not scrap, no charge can be made for a new axle.

Question—When a cut-out cock is applied in connection with a new cross-over pipe what is the proper number of connections to charge? *Answer*—Actual number of connections necessary to renew a cut-out cock should be deducted from the total number of connections made.

Question—Can material and labor be charged for a new triple-union nut and swivel if renewed in connection with the cleaning of air brakes? *Answer*—Yes. The material for a union nut, swivel and one connection.

Question—Have patents on Bettendorf truck sides expired and if so how are they to be charged when applied to a foreign car? *Answer*—We understand patents on these truck sides have expired and they should be charged on a pound basis under Rule 101.

Question—A new all-steel car with No. 2 plus beams standard

(*Continued on page 699*)

First Air-Conditioned Car in the West

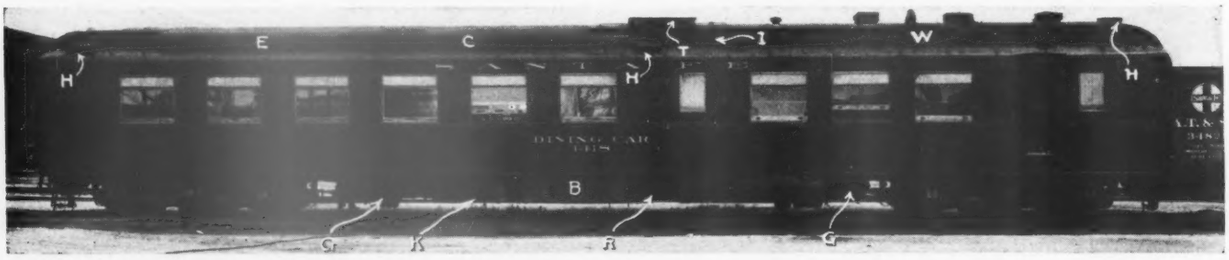
Operated by the Santa Fe in transcontinental passenger service—Equipped with the Carrier system

AIR-CONDITIONED passenger equipment received its first trial in western railroad operation during the past summer when the Atchison, Topeka & Santa Fe placed a new diner, No. 1418, in regular transcontinental service on its train known as the "Chief." This new diner, notable both for distinctive interior decoration and equipment and for the provision of a complete system for condition and cooling the air in the dining room under the most adverse conditions of outside air temperature and humidity, has been well received by the traveling public. On the initial test runs in desert country, it was established that, with the car loaded with passengers, the kitchen stoves all in operation and a temperature of 104 deg. F. outside, it was possible to maintain a temperature of 72 deg., or less, in the dining room.

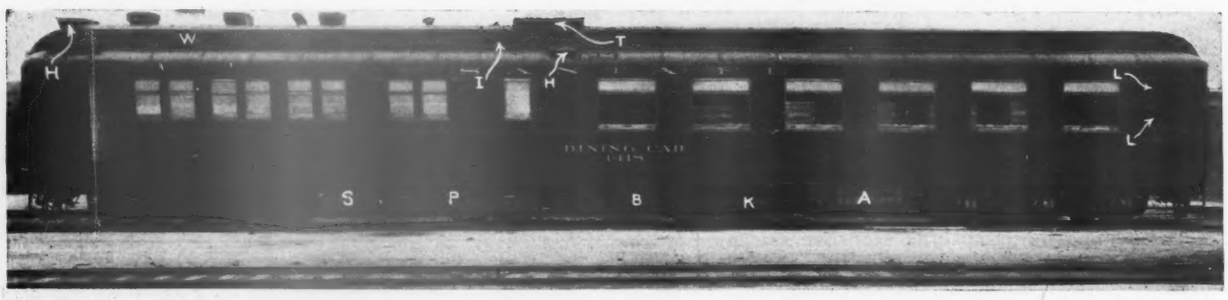
This diner, built by the Pullman Car & Manufacturing Corporation, is 83 ft. long, seats 36 persons and has a light weight of 209,000 lb. It is provided with an air-conditioning system, manufactured by the Carrier Engineering Corporation, Newark, N. J., and similar in general principle to the Carrier air-conditioning system recently applied in the dining car "Martha Washington" which was described in the *Railway Mechanical Engineer* issue of September, 1930, but differing from it principally in that 32-volt electric power is used throughout, storage batteries are provided to carry the load while standing or during slow-speed operation, important changes have been made in location of detail parts, and a different method is used for introducing conditioned air into the dining-room.

Installation of the System of Air Conditioning

The installation of the Carrier system in diner No. 1418 is shown in the two perspective drawings. The system is installed without any sacrifice of interior beauty. In fact, the upper deck is entirely free of deck sash and ventilators, and presents a pleasing appearance. Electric fans, always more or less of a problem to locate satisfactorily in dining cars, are omitted entirely. The tapered sheet-metal air ducts, designed to give a uniform distribution of air throughout the length of the dining-room, are located between the ceiling and the upper deck or roof, being provided with 23 long, rectangular outlets at the deck rail on either side of the car. A long diffusion plate, about 5 in. wide, and located just under each row of deck-rail openings, assists further in distributing the conditioned air uniformly throughout the dining-room, without in any way detracting from the harmony of the interior design. The cooling and air-conditioning system is installed with the loss of only a single locker, in one end of the car, utilized



A—Motor-driven refrigeration unit
B—Electric storage-battery box
C—Refrigerant condenser tank
E—Refrigerant evaporator tank
G—Generator with direct drive from axle
H—Hatch for icing refrigerator from roof
I—Air intake with manually operated shutter
K—Part of the air-brake equipment
L—Louvers to cooling tower
P—Iced provision box
R—Water system pump
S—Box for kitchen coal
T—Trap door to blowers
W—Kitchen deck sash, roof ventilators and smoke jack

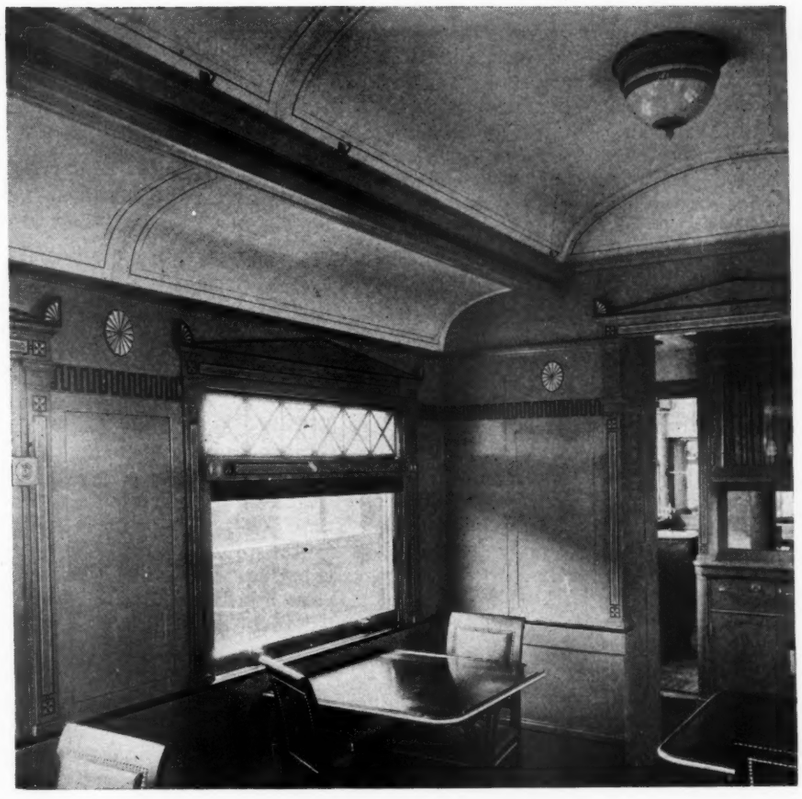


Side views showing location of the air-conditioning equipment on the Santa Fe diner

for the water-cooling tower. No additional insulation is used in the side walls of the car. The air ducts for the cooling system, however, are heavily insulated with 2-in. cork.

The control of the air-conditioning system is notable for its simplicity. Closing a single contact puts the entire unit in operation by means of automatic switches and relays. The only other control necessary is the movement of two out-door air dampers operated by a single handle over the pantry door in the buffet lobby. The adjustment of this handle and of the dampers, depends upon the number of passengers in the dining-room.

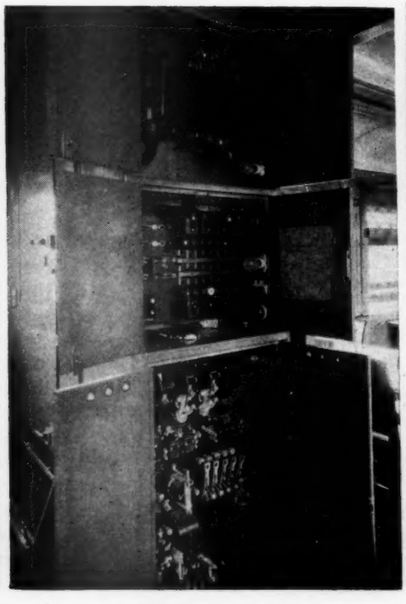
Power for the air-conditioning system on the Santa Fe diner, as well as the lighting load, is taken from two Safety 7½-kw., 32-volt generators, with Foote direct-drive from the inside car axles. Three 750-amp.-hr. Exide Ironclad batteries, with a total capacity of 2,250 amp. hr., are connected in parallel across the line to provide reserve power for the cooling and lighting load at stations and at speeds below approximately 15 miles an hour, when the generators cut in. The battery acts as a flywheel on the power system when the air-conditioning motor load goes on or off, and provides sufficient reserve capacity to keep the light and the air-conditioning system in operation for six to eight hours, unaided by the generators.



The diffusion plate under openings at the deck rail deflects and spreads cool air as it enters the dining room

Not only is it necessary on the Santa Fe to provide for air conditioning while the train is operating on long grades and at speeds necessarily less than required to enable the generators to carry the full load, but due precautions must be taken to guard against damage to the equipment under widely varying and extreme temperature conditions. For example, air conditioning may be required in service on the desert one day, and freezing temperatures be encountered the next, in the mountains or on the eastern end of the line. Consequently, the system is designed with the condenser and evaporator tanks on the roof, all water draining back into the inside of the car upon shut-down of the system. A special anti-freezing mixture, known as Carrene, is circulated through the water jackets of the refrigeration compressor for cooling purposes, owing to the unavoidable lo-

Re-circulated air intake in buffet ceiling



Electric-control panels compactly arranged

Water-cooling tower located in corner locker

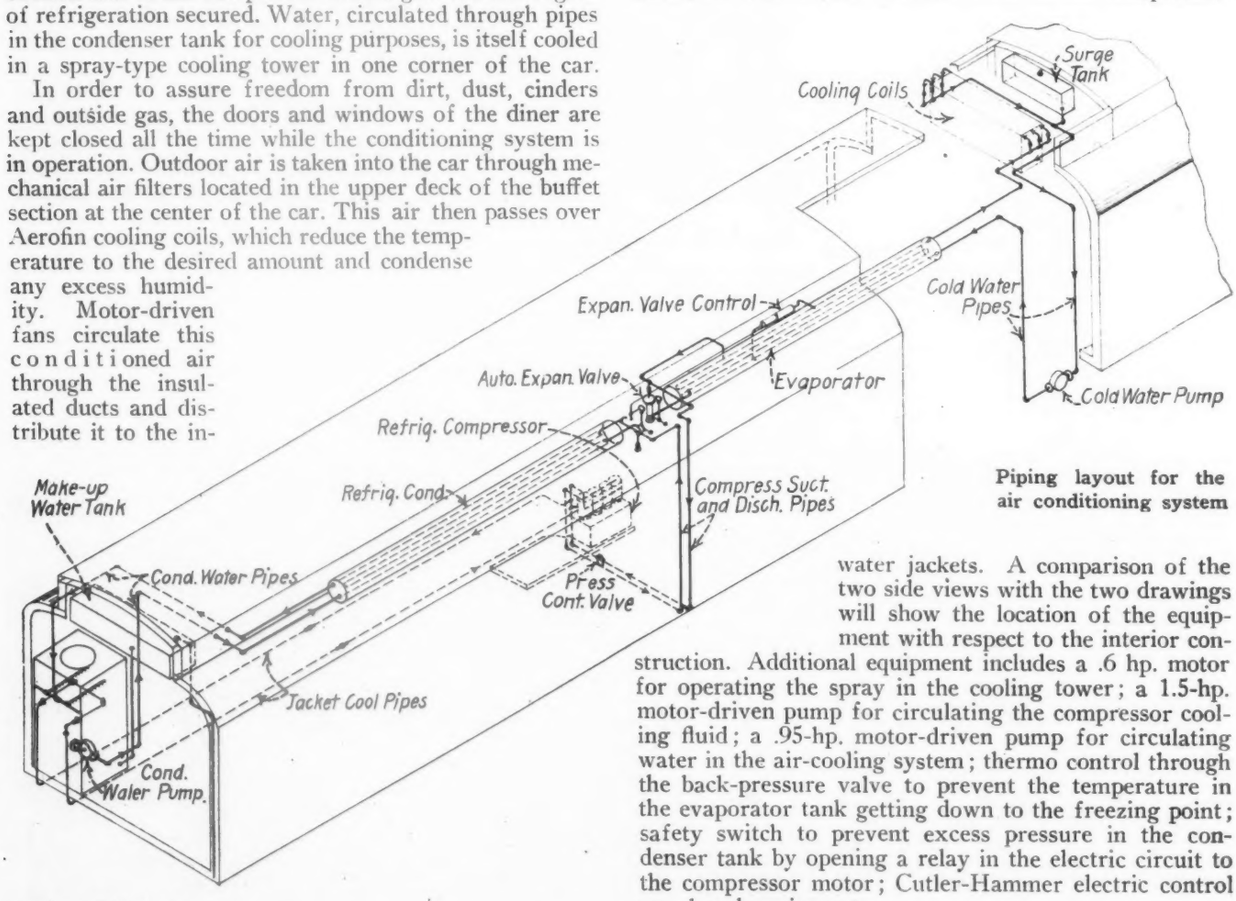
cation of this unit in an exposed position underneath the car. Automatic louvers, admitting air to the water-cooling tower, can be closed in winter.

The car is heated for winter use with the Vapor car heating system, using fin pipes instead of ordinary pipes. This heating system is thermostatically controlled, the ventilation is provided in winter by the motor-driven blowers circulating air which is warmed by the Vapor system. The only difference from summer operation is that the compressors, refrigerant evaporator and cooling water tower are not in operation.

Operation of the Air-Conditioning System

The foundation of air conditioning on the Santa Fe diner is a compression refrigerating system, by means of which the compressed refrigerant passes through a condenser tank where it is cooled and liquefied, then expanding through a special valve to an evaporator tank, in which it absorbs heat from water circulated through an air-cooling unit. The return of the refrigerant under relatively low pressure, to the compressor, completes the cycle. An automatically-operated discharge valve in the suction line to the compressor intake governs the degree of refrigeration secured. Water, circulated through pipes in the condenser tank for cooling purposes, is itself cooled in a spray-type cooling tower in one corner of the car.

In order to assure freedom from dirt, dust, cinders and outside gas, the doors and windows of the diner are kept closed all the time while the conditioning system is in operation. Outdoor air is taken into the car through mechanical air filters located in the upper deck of the buffet section at the center of the car. This air then passes over Aerofin cooling coils, which reduce the temperature to the desired amount and condense any excess humidity. Motor-driven fans circulate this conditioned air through the insulated ducts and distribute it to the interior of the car.



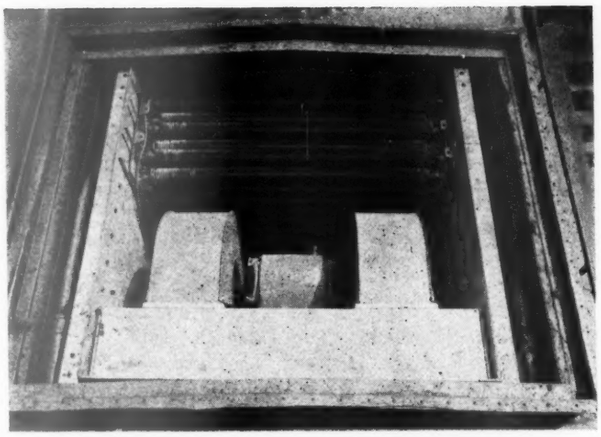
Piping layout for the air conditioning system

Air from the dining-room re-enters the cooling system at a grating in the ceiling of the buffet section, where it is again mixed with the right amount of outside air and passes through the duct system. When the temperature of the dining compartment reaches a predetermined point, usually set at 10 or 15 deg. below the outside temperature, a temperature regulator and mechanical interlock closes the louvers, or moving vanes at the intake, permitting the re-circulation of air within the car without passing over the cooling coils. As the car temperature rises, the reverse operation takes place and automatic temperature regulation is provided. The amount of out-door air required is governed by the number of passengers in the dining compartment, being controlled by manually-operated shutters on each side of the middle deck of the car.

Location of the Air-Conditioning Equipment

Referring to the two side views of the Santa Fe diner, the principal parts of the air-cooling and conditioning system, in addition to the generators *GG* and batteries *BB*, already mentioned, include a refrigeration compressor, driven by a 7½-hp. electric motor, and located in the compressor box *A;* refrigerant condenser tank and evaporator tank, located at *C* and *E* on the car roof; motor-driven blower and air-cooling coils located in the roof of the car under the trap door T; an air intake *I* on each side of the car, with manually operated shutter to admit outside air through steel-wool filters to the cooling unit and two double-inlet blowers, spray-type cooling tower, with louvers *LL*, located in a locker in one corner of the car and designed to cool the condenser water, as well as the Carrene used in the compressor water jackets. A comparison of the two side views with the two drawings will show the location of the equipment with respect to the interior construction. Additional equipment includes a .6 hp. motor for operating the spray in the cooling tower; a 1.5-hp. motor-driven pump for circulating the compressor cooling fluid; a .95-hp. motor-driven pump for circulating water in the air-cooling system; thermo control through the back-pressure valve to prevent the temperature in the evaporator tank getting down to the freezing point; safety switch to prevent excess pressure in the condenser tank by opening a relay in the electric circuit to the compressor motor; Cutler-Hammer electric control panel and equipment.

The refrigerant system is closed and does not normally require replenishment, except at infrequent intervals. The cooling-water system to the Aerofin cooling unit also is closed and does not lose water, but condensation of moisture in the air passing through the unit produces more or less water which is disposed of through a waste pipe. This is the method of removing moisture from the incoming air and controlling the humidity. The water in the cooling tower is sprayed by a motor-driven pump and cooled as it passes downward through air taken in



Motor-driven blowers and aerofin coil unit used in cooling the air

through the louvers from the outside of the car. More or less condenser water is evaporated by this process and, under extreme conditions, make-up water to the amount of about 12 gallons an hour may be required, supplied from a tank in the top of the car and through an automatic float control valve located in the cooling tower.

Special Equipment

The Safety 7½-kw., 32-volt electric generators are connected in parallel and governed by constant-potential regulators adjusted to 37 volts. These generators, with the gear reduction at present included in the Foote direct drive from the inside car axle on each truck, begin to relieve the batteries of load at about 15 miles an hour and carry full load at 20 to 25 miles an hour. The three 750-amp-hr. Exide Ironclad storage batteries are connected in parallel across the line, the batteries being conveniently located in the usual manner, as illustrated, in battery boxes under the car. The Cutler-Hammer control panel and equipment provide practically automatic and fool-proof operation of the electrical equipment. All motors are protected by overload relays and low voltage relays. In wiring the car sufficient copper was used to avoid excessive voltage drop. The entire design of the car from a mechanical as well as an electrical standpoint was developed with a view to securing a high factor of safety and maximum reliability of operation.

A. R. A. Billing

(Continued from page 695)

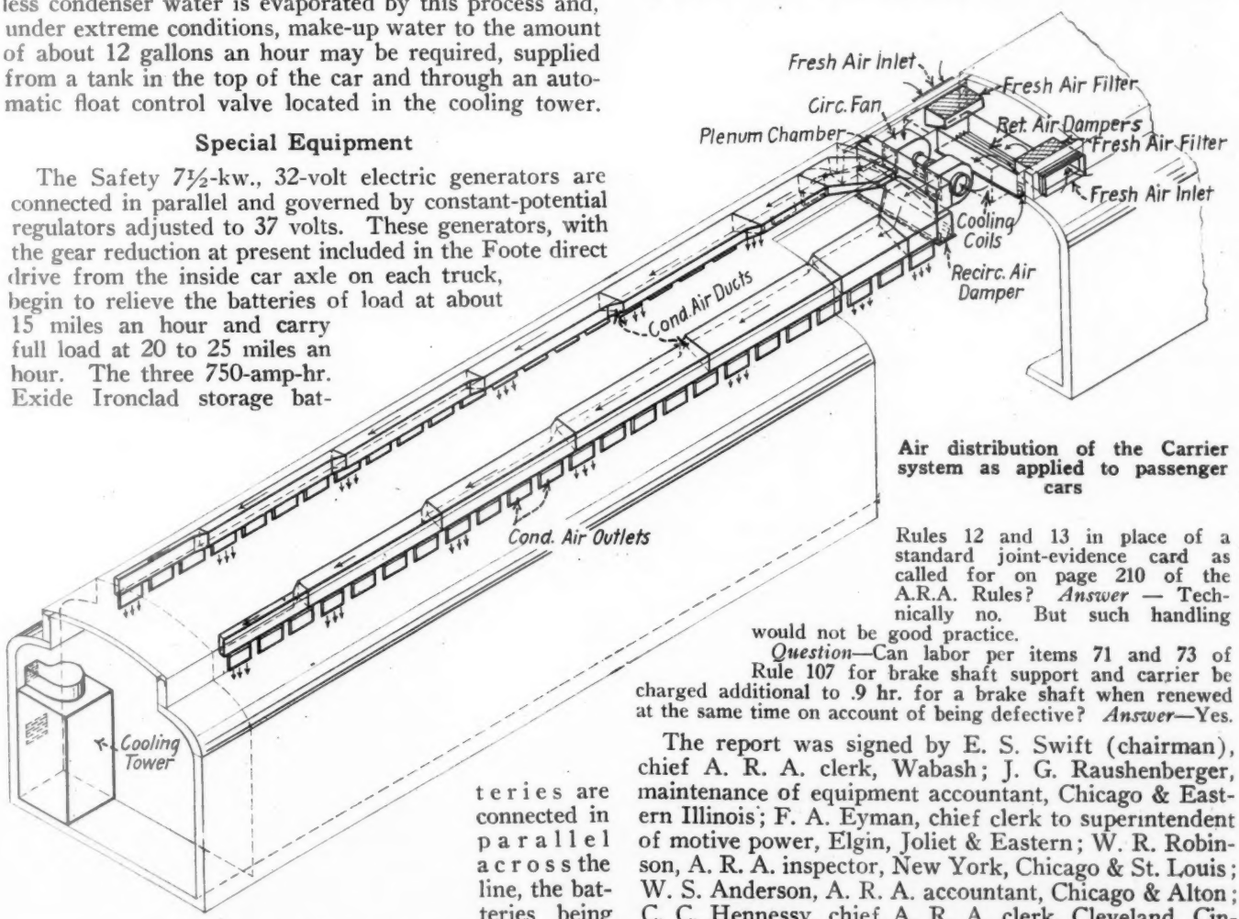
is repaired by a foreign road. The repair card shows a No. 2 beam removed and a No. 2 applied. What recourse has the owner? *Answer*—The owner should get joint evidence, per Rules 12 and 13 and ask for a defect card when the wrong repairs have been corrected.

Question—In view of decision in Arbitration Case 565 can a repairing road apply a new type D coupler complete in place of type D broken shank and charge the owner with a betterment? *Answer*—Yes. Arbitration Case 565 is obsolete. See third paragraph of Rule 104 and Arbitration Case 1614.*

Question—What is the proper labor charge for application of a side door frame to a stock car door where it is necessary to repair and renew 20 or 30 bolts? *Answer*—Two hours, per Item 148 of Rule 107. Door fixtures repaired and renewed to be charged extra.

Question—A foreign road in making heavy repairs to a car damaged in a derailment finds it necessary to repair and renew some items which are considered by the owner as wrong repairs. Can the repairing road be held responsible for wrong repairs which they merely repair and renew and do not apply? *Answer*—No.

Question—Can a joint inspection certificate be used under Rules 12 and 13 in place of a standard joint-evidence card as called for on page 210 of the A.R.A. Rules? *Answer* — Technically no. But such handling would not be good practice.



Air distribution of the Carrier system as applied to passenger cars

Question—Can labor per items 71 and 73 of Rule 107 for brake shaft support and carrier be charged additional to .9 hr. for a brake shaft when renewed at the same time on account of being defective? *Answer*—Yes.

The report was signed by E. S. Swift (chairman), chief A. R. A. clerk, Wabash; J. G. Raushenberger, maintenance of equipment accountant, Chicago & Eastern Illinois; F. A. Eyman, chief clerk to superintendent of motive power, Elgin, Joliet & Eastern; W. R. Robinson, A. R. A. inspector, New York, Chicago & St. Louis; W. S. Anderson, A. R. A. accountant, Chicago & Alton; C. C. Hennessy, chief A. R. A. clerk, Cleveland, Cincinnati, Chicago & St. Louis; W. F. Barse, chief A. R A. clerk, Southern; J. M. Bremser, chief clerk A. R. A. billing department, Chicago, Milwaukee, St. Paul & Pacific; C. E. Ahlquist, chief A. R. A. clerk, Union Pacific; Edward Goettmann, chief clerk, mechanical department, American Refrigerator Transit Company; O. H. Clarke, supervisor of car repair billing, Gulf Coast Line; W. M. Grubbs, master car builder, Barnsdall Refining Company.

*An abstract of Arbitration Case 1614 was published in the January, 1930, *Railway Mechanical Engineer*, page 36.

Roy V. Wright

President of the American Society of Mechanical Engineers for 1930-1931

A Tribute by His Associates

GOING over the boss's head without his knowledge is a bit unusual in any organization. But because we are proud that Roy V. Wright, editor of the *Railway Mechanical Engineer,* has been chosen president of the American Society of Mechanical Engineers for the year 1931—a signal honor in the mechanical engineering profession—we have taken it upon ourselves to pay him this tribute, in which we believe our readers will join.

Some of us have been associated with Mr. Wright for considerably more than a decade. All of us knew of him and of the work he was doing when we were in railroad service. We have followed his career as an editor and as a member of the American Society of Mechanical Engineers for many years. His election to the presidency of the society is an honor which he richly deserves, and we take this occasion—the month of his inauguration—to join his other friends in the railroad industry in expressing our pleasure that he has been given this opportunity for added service in a broader field.

THE EDITORIAL STAFF.

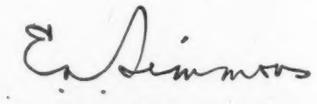
THE "boss" being the editor of the paper and the final arbiter concerning what appears in its text pages, the above statement means that his well-equipped staff of associate editors—C. B. Peck, E. L. Woodward, Marion B. Richardson, H. C. Wilcox and W. J. Hargest—have taken it upon themselves to insert an unusual editorial comment which will not have been seen by the editor until its appearance in the publication—something that seldom happens.

The "heap-big-chief's" contact with Roy V. Wright covers more than two decades, dating back to 1904 when Mr. Wright was associate editor of American Engineer and Railroad Journal, now *Railway Mechanical Engineer.* He came to us March 1, 1910, assuming the roll of mechanical department editor. In 1912 he was appointed both editor of *Railway Mechanical Engineer* and managing editor of Railway Age.

It is an honor to any man that he should be elevated to the office of President of the American Society of Mechanical Engineers; but with Roy Wright it may well be said that the honor is reciprocal. Born at Red Wing, Minnesota, October 8, 1876; a graduate of the University of Minnesota with the degree of M. E., he began his business career as a machinist apprentice on the Chicago, Milwaukee & St. Paul (1898). Next he went to the Chicago Great Western, where he worked successively as special apprentice, draftsman and chief draftsman (November, 1899-March, 1901) going from there to the Pittsburgh & Lake Erie as mechanical engineer (1901-1904). His first editorial experience was with the late George M. Basford on the American Engineer and Railroad Journal, Mr. Wright having left the Pittsburgh & Lake Erie to go with that publication.

As editor of *Railway Mechanical Engineer* and managing editor of Railway Age, Mr. Wright has traveled much, not alone seeking information and getting acquainted with railway officers but also in promoting the welfare of American railroads through appearances before large gatherings of executives and employees alike, especially when they had to do with the Y. M. C. A. With the American Society of Mechanical Engineers, Mr. Wright has been a prominently active worker for the past ten years or more, serving as manager from 1922 to 1925 and as vice-president in 1926-1927. Also, he was vice-president of the United Engineering Society in 1927 and president 1928-1929.

To Mr. Wright's scholarly attainments are added a charming personality, dependable loyalty and constructive aggressiveness. Beloved by all by whom he is surrounded, in office and home alike; a red-blooded man of sterling character whose private life will bear closest scrutiny, he is an example for all who would successfully climb the ladder of life.



President, Simmons-Boardman Publishing Company.

EDITORIALS

Order Your Index Now

MUCH of the value of the material in each issue of the *Railway Mechanical Engineer* is undoubtedly realized by the use which our readers make of it immediately after they receive their copies. In the course of a year, however, many articles are published which, at the moment, may not have a direct bearing on the current problems of all of our readers but which may be of considerable value at some time after the date of the issue in which they appeared has been forgotten. Other articles are of such a nature that they have more or less permanent reference value. To meet just such conditions an index for the twelve issues published during each calendar year is compiled, alphabetically according to subject matter, so that any of the material appearing during the year may be readily located. A copy of each year's index is mailed to each subscriber who wishes to have one. If you have received last year's index, you will continue to receive succeeding issues as long as you are a subscriber without further attention on your part. If you have not already asked to have your name placed on the index mailing list, do so at once. A copy of the 1930 index will then be mailed to you as soon as it has been printed and you will continue thereafter to receive a copy of each succeeding issue.

Applying Rule 4

EVERY interchange inspector knows that the proper use of defect, original record of repair, billing-repair and joint-evidence cards is important to the successful functioning of interchange of equipment. Nevertheless, evidence that Rule 4 of the A. R. A. Rules of Interchange was being misconstrued and cards not being used in accordance with the intent of the rule was brought forward at the second annual convention of the Car Department Officers' Association which was held at Detroit the last week in August.

Rule 4 states; "In case of damage to a car for which the delivering line is responsible, such line must at the first available inspection point, attach a defect card to cover. If the car is in the shop and a portion only of the unfair-usage damage is repaired, a defect card must be applied before the car leaves the shop. If the car is offered in interchange with delivering-line defects, the receiving line shall require that a defect card be securely attached to the car, as per Rule 14."

This paragraph of the rule is clear and there should be no misunderstanding as to its intent and requirements. Cards are sometimes lost, as pointed out in one of the letters included in the abstract of the report of the association Committee on A. R. A. Billing published elsewhere in this issue. The suggestion to provide a receptacle on each car from which cards will not be lost is worth consideration. Cards tacked to a car as prescribed in Rule 14 are too liable to be torn off.

The second paragraph of Rule 4 permits considerable latitude in its interpretation. It reads as follows: "Defect cards shall not be required for any slight damage (new or old), that of itself does not require repairs." This statement is followed by six specific examples of damage for which defect cards are not required unless damaged to the extent specified in the rule. The last paragraph of the rule states; "Defect cards shall not be required for missing material in fair usage from cars offered in interchange. Neither shall they be required of the delivery company for improper repairs not made by it, with the exception of the cases provided for in Rules 57 and 70." The former refers to mounting air hose and the latter to wheels.

The intent of Rule 4 is clear. The only point open to controversy is—how slight is "slight damage." Any attempt, however, to clarify this statement would mean the listing in the rule book of every possible case of damage to a car which would not affect its utility from the standpoint of the shipper or the safety of its operation by a railroad. Such a list would be so long that its compilation and publication would be impracticable.

No law, rule or regulation, was ever written so perfect that it did not allow some loophole for argument over details or quibbling. The Rules of Interchange state that each railroad is responsible for the condition of all cars on its line, and must give to all, regardless of responsibility, equal care as to inspection, oiling, packing and running repairs. This defines broadly the attitude of the Arbitration Committee as to how it will interpret the rules when applied to specific cases. After all, much of the difficulty with respect to complying with Rule 4 is not caused by any defect in the wording of the rule itself but in the attitude of mind of some interchange inspectors.

Dry Weather and Large Tanks

WHEN the tendency toward the application of large capacity locomotive tender tanks first got under way in this country many mechanical officers were skeptical of the value of what seemed to be the extremely large tenders that were being applied on some roads. Operating experience during the past five years has demonstrated that large capacity tanks have contributed to the speeding up of train movements by eliminating the necessity for frequent water stops. It took the drought conditions of the past summer and fall to bring out some of the real assets of large tanks on certain roads in the dry areas. Water conditions in some localities have been such as to present a serious obstacle in the maintenance of locomotives, particularly with respect to boilers.

On one road 60 out of over 200 water stations were unable to meet the demand for water for locomotives while the quality of the water at many of the other stations was such as to render it unsuitable for use. A recent report made to the chief mechanical officer of the road is of sufficient interest that it is quoted in part as follows: "The new large capacity tanks have been of considerable help in meeting drought conditions on this road. By increasing the safe distance an engine can run for water with full tonnage it has been possible in most cases to pass the stations which are dry and hold

the stations on which orders have been placed for emergency. A further advantage is in permitting the engines to select the water stations where the quality is better and avoid the places where the water is not so good. This has assisted in keeping the boilers in better condition and generally improving locomotive operation."

Outside Tire-Turning Operations Successful

THE practice of turning locomotive driving-wheel tires without dropping the wheels or using a wheel lathe, but simply by hauling the locomotive along a stretch of track with the brakes applied and cutting tools in dummy brake heads, is evidently quite widespread throughout the country. A great diversity of opinion exists regarding the best method of operation, but there is no real doubt about the accuracy and success of the method when carried out within proper limitations and under adequate supervision. This is proved by the fact that outside tire turning is followed in greater or less degree by such representative roads as the Baltimore & Ohio, the Pennsylvania, the Burlington, the Milwaukee, the Chicago Great Western, the Northern Pacific, the Soo Line, the Rock Island, and the Great Northern, to mention only a few.

For one reason or another, some roads, like the North Western and the Illinois Central, do not follow the practice at all. Others, like the Pennsylvania, Western Region, limit it to switching power, and still others, to switching and freight power, turning all passengers driving-wheel tires in the shop wheel lathe. The Milwaukee, on the other hand, is one of the roads which uses the method for all classes of power with good results. In the past three years, this road has turned the tires on 240 locomotives outside the shop at Milwaukee, Wis., as described in an article elsewhere in this issue. It finds that where due care is taken in selecting the tires to be turned and checking the entire operation throughout with calipers and a ball-center gage to assure roundness, the practice effects substantial economies in labor cost and reduces locomotive out-of-service hours.

Locomotive driving-wheel tires are, of course, turned outside of the shop only when the condition of the boiler and other machinery does not warrant complete overhauling and class repairs. In that case, by cutting down the flanges and high spots on the tires outside of the treads, it is readily possible to condition the locomotive for further service without the expense and delay of unwheeling, or, as is sometimes done, removing the rods and tires and applying new tires. Among other advantages, this practice tends to permit maintaining a high standard of tire condition and conserves service metal, since tires are not allowed to run until the flanges and treads are excessively worn.

Experience on the Milwaukee and other roads indicates that an outside source of power for hauling the locomotive at a uniform speed is absolutely essential to satisfactory cutting; that all tires must be turned simultaneously for the best results; that one machinist and one helper can handle the entire operation if electric push-button control of the locomotive movement is provided in the cab; that, with a locomotive speed, and, consequently, cutting speed, of 25 ft. per min., a set of tires can be turned in six to eight hours.

Two unexpected valuable by-products have also been discovered as a result of the operation of turning locomotives tires outside of the shop. In the first place, the careful checking of tire diameters, necessitated by the practice, frequently shows up differences due to unequal wear or inaccurate initial turning, which would otherwise go undetected and uncorrected. Second, since the first operation in tire turning by this method is to check the working of the brake equipment and foundation brake rigging to assure the delivery of equal pressures to all brake shoes, this important detail of locomotive construction receives expert attention. It is said to be surprising how many irregularities exist that might otherwise not be discovered.

The subject of tire turning without unwheeling is by no means closed, and the *Railway Mechanical Engineer* does not pretend to know the "last word" about it. The practice apparently has a distinct and legitimate field of usefulness, however, when properly supervised, and additional comments of experienced railroad mechanical officers regarding it are solicited.

How Do You Compute Reweighing Dates?

ON the Reader's Page of this issue appears a letter inquiring as to correctness of a statement made in the August issue of the *Railway Mechanical Engineer* regarding the selection of cars for reweighing and re-marking as specified in paragraph C, rule 30, of the A. R. A. Interchange Rules. The statement in question appeared in an article entitled, "Personal Contact with the Car Inspector" and reads as follows: "In selecting cars for re-light-weighing the month stenciled on the car is counted as a month in computing the date at which the car is due for re-light-weighing." It is a quotation from the minutes of one of a series of car inspector's meetings which were instituted on one railroad as a means of acquainting its inspectors with various changes in, and problems arising from the interpretations of the A. R. A. Interchange Rules.

The letter referred to states that this method of selecting the date for reweighing the cars appears to be contrary to the decision rendered by the A. R. A. committee in Arbitration Case No. 1462. In the case mentioned, the Southern Pacific took exception to the charges made by the St. Louis-San Francisco for re-light-weighing one of its cars on October 7, 1924, the old weighing date of which was April 4, 1923. The exception was taken on the grounds that 18 months had not expired at the time the work was performed and was based on the contention that the old weight should have been in its nineteenth month before the car was due for reweighing. The contention of the Southern Pacific was in this instance sustained by the Arbitration committee.

Paragraph C, rule 30 of the A. R. A. Interchange Rules states that all-steel cars and all refrigerator cars should be reweighed and re-marked at least once every 36 months. Such reweighing and re-marking may be done after the expiration of 18 months (for wooden and steel-underframe cars) and 30 months (for all-steel and all refrigerator cars) from the month in which the previous weight was obtained.

In the case mentioned, the old date being April 4,

1923, the expiration of 18 months would have occurred at the end of October 4, 1924, if the day of the month on which the car was previously weighed and stenciled could be taken into consideration in determining the date when the car would again be due for weighing and marking. The car was reweighed and re-marked on October 7, 1924. However, from the decision rendered in Arbitration Case No. 1462, the date on which a car is due for reweighing and re-marking should be calculated from the end of the calendar month in which the car was previously weighed and stenciled.

If the interpretation of Paragraph C, rule 30, as given by the group of inspectors mentioned in the article, "Personal Contact with the Car Inspector" is any criterion, it might be well for all inspectors to acquaint themselves with the decision as rendered by the Arbitration Committee in Case No. 1462. The group of inspectors referred to arrived at the conclusion that the month in which a car is weighed and marked is counted as a month in computing the date on which the car is due for reweighing. This, it would appear, is not the interpretation given paragraph C, rule 30, by the Arbitration Committee.

Possibilities in Gas Cutting

IN general, the savings by the use of the Oxyacetylene gas cutting torch in railway shops and reclamation plants are too large for estimate with any appreciable degree of accuracy. In boiler shops, for example, staybolts and rivets are now cut out with the torch and fireboxes removed in an almost unbelievable short period compared with that formerly required with air drills, rivet and staybolt "guns," etc. Locomotive and car stripping operations have been so greatly expedited that shop men no longer shy away from this work on account of its arduous and dangerous character.

The possibilities of the cutting torch in scrap classification also are very great, as ably stated by G. W. Lieber, superintendent of reclamation, Missouri-Kansas-Texas, at the thirty-first annual convention of the International Acetylene Association, Chicago, November 12, 13 and 14, 1930, as follows: "One of the most outstanding and profitable developments to the railroads occasioned by the use of oxyacetylene torch is in the preparation of scrap. The railroads produce over 50 per cent of the entire accumulation of scrap in the United States, which amounts to millions of tons a year. Prior to adopting the use of a cutting torch in the preparation of scrap, the entire accumulation was sold as a very low grade and the price obtained per ton was lower than the amount received in the past few years for an average classification. Through the use of the cutting torch, lower grades of scrap are prepared to higher classification at a small cost per ton. The price received for the higher grades is often five times the actual cost per ton to prepare the scrap with the aid of an oxyacetylene cutting torch. This method of preparing scrap has been instrumental in giving the railroads many thousands of dollars for their accumulation which was formerly sold to individuals who assorted and prepared to a classification that brought enormous profit."

The gas cutting torch has thus demonstrated beyond question its wide adaptability as a time-, labor- and money-saving device in railway operations, and doubtless its value to the respective roads will be still further increased as additional economic uses are developed.

NEW BOOKS

CRANE ENGINEERING. *Published by the Whiting Corporation, Harvey (Chicago), Ill., 160 pages, 5 in. by 8 in., illustrated. Bound in leather. Price $2.*

This Handbook of Crane Information is the result of a number of years' experience in crane manufacture and represents the combined efforts of the engineering service, development and sales divisions of the Whiting Corporation to present to the crane user and prospective buyer information not usually found in the ordinary manufacturer's catalog. It is believed to be the first book of its kind ever published by a crane builder and should be of technical and practical value to executives and engineers. The book is divided into eighteen sections, there being chapters on How To Select a Crane; Duty Classification of All Types of Cranes; Standard Clearances for Overhead Electric Traveling Cranes; Average Range of Speeds for all Classes of Duty; Runways for Overhead Travelling Cranes; Crane Erection; Crane Lubrication, etc.

OIL CONSERVATION AND FUEL OIL SUPPLY. *Published by the National Industrial Conference Board, Inc., 247 Park Avenue, New York. 166 pages, 6 in. by 9 in. Illustrated with diagrams and charts. Price $2.50.*

In order to supply comprehensive information concerning the basic facts underlying the problem of oil conservation and fuel oil supply, the National Industrial Conference Board has undertaken a series of studies to show the world consumption and production of the various forms of energy. The study presented in "Oil Conservation and Fuel Oil Supply" gives a detailed analysis of the factors that determine consumption and production of fuel oil. The various uses of fuel oil, the combination of these uses with one another and the extent to which other sources of energy, particularly coal and natural gas, compete with the present and probable future supply of fuel oil are considered, especial reference being made to the effects of a possible decline in supply under a conservation program. There are four parts and an appendix to the book, lists of tables and charts, and map inserts showing for 1929 the regional consumption and production of coal, natural gas, fuel oil, gasoline and developed water power.

RECHNERISCHE UNTERSUCHUNG DER WÄRMEÜBERTRAGUNG IM LOKOMOTIV-LANGKESSEL. *By Dr. Ing. Ulrich Barske. Bound in paper, 6 in. by 8½ in., 90 pages, illustrated. Published by Hanomag-Nachrichten-Verlag G.m.b.H., Hannover-Linden, Germany. Price 3 Reichmarks.*

The correct translation for the title of this book, which is published in German, is "Arithmetic Investigation of the Heat Transposition in the Locomotive Boiler Barrel." According to the publishers, this book, presents for the first time exact equations for determining the transfer of heat in the locomotive boiler, based on the most recent scientific discoveries. The diagrams and illustrations, calculations and deductions are of interest not only to the locomotive designer, but also to the heat engineer.

The first part of the book is devoted to the consideration of recent researches in heat transfer. This is elaborated with mathematical equations for determining the variations in temperature in boiler tubes, flues and superheaters. The second part of the book gives examples for the practical use of the equations, diagrams and tables given in the first part.

THE READER'S PAGE

Determining the Correct Date for Reweighing Cars

To the Editor:

In your August, 1930, issue, beginning on page 465, is an article entitled "Personal Contact With the Car Inspector." On page 466, column 2, paragraph 8, it is stated that in selecting cars for reweighing, the month stenciled on the car is counted as a month in computing the date on which the car is due for reweighing.

This appears to be contrary to decision in A. R. A. Arbitration Case No. 1462. I have a number of cases where car owners are requesting cancellation of charges for reweighing their equipment when we arrived at the date due for reweighing in accordance with this method of determining the reweighing date.

Master Mechanic.

(Arbitration Case No. 1462 was decided in favor of the Southern Pacific which contended that a car should not be reweighed and re-marked until it was in its nineteenth month after the previous reweighing date. The Arbitration Committee's decision in this case is discussed in an editorial in this issue.—Editor.)

"Top Sergeant" Is Right?

Roselle, N. J.

To the Editor:

Top Sergeant is right when he says "Railway employees are out for all they can get." Certainly, and there is not a railroad officer who would deny them that, if—and there is the hitch—they deliver the goods. However there are two parties to this "getting game," the getter and the giver. Here is where the foreman enters —Bill Brown and Top Sergeant. They are to see to it that both employees and employers are getting a fair break.

Their methods seem to differ greatly, although both are aiming at the same objective; namely, that the maximum amount of efficient labor be obtained for each hour paid for. This implies that they must so organize the personnel and secure the co-operation between all the forces and individuals composing it that the physical facilities provided by the railroad management will be used with the greatest practicable skill.

One of the requisites to make this a fact is that every supervisor and employee will have to have the right attitude and the right spirit towards his job. The employee's attitude towards his job is influenced mainly by considerations such as permanent work, good wages, fair treatment, opportunity for betterment and self improvement, pleasant surroundings and sanitary and comfortable working conditions.

It would be interesting to know to what extent Bill Brown's coddling policy, as Top Sergeant puts it, has succeeded in raising the standard of efficiency in his shop. Has it stood the test of the present severe business depression when it becomes imperative to cut down forces and reduce the monthly payrolls?

Perhaps Bill Brown will tell us what new incentives he has found to combat the difficulties of the present hard times and further to reduce expenses and increase output. A railroad shop, like any other shop, for that matter, is first of all a cold business proposition. It would seem that Top Sergeant is sold line, hook and sinker to that idea. He therefore, no doubt, believes in paying the employees in proportion to the amount and character of the work they do. That is sound business, but it is hard to make payment along such lines unless on a piece-work basis.

The incentives offered the employees under a piece-work plan are many, and the writer would like to know if Top Sergeant's shop is on a piece-work or bonus system, and further if improved methods of shop operation have been brought about by careful study of shop conditions by a force of trained men who devote their entire time to the job.

Most every employee has at some time or other, and to a more or less extent, opportunities for pointing out an improvement in some detailed method or short cut for doing the work. Such improvements will result in small but tangible economies in repair costs if measured over a period of years, and the resultant cumulative savings will reach surprisingly large amounts.

Has Top Sergeant evolved a new plan, other than the suggestion plan, to have employees make valuable suggestions as outlined above? How does he combat radical theories and tendencies of irresponsible agitators among his men? It has been stated as an inrefutable fact that every device and invention to save labor has in the end benefited labor far more than capital. However, the agitator will make his fellow workers suspicious and try to prove the opposite to be true.

It would be of value to know what educational methods Top Sergeant and Bill Brown employ so their men will not be deceived.

L. I. Berty.

Another Comment on Variable Lead

To the Editor:

The three letters on variable lead for the Walschaert valve gear, published in the October issue, overlooked an important point which I would like to bring to the attention of your readers. There are a number of "proportion altering" contrivances to be incorporated in Walschaert valve gear; the proportion altered being the short division of the combination lever, i.e., the value of the short division being increased as the link block is shifted toward the link trunnion.

But why introduce more members in the mechanism? The number of men who have been attentive to the Walschaert, Baker and Southern valve gears and who know that "crossed lead" is possible with them is large. All that is necessary to obtain variable lead with the above mentioned-linkages is appropriate length and position of the return crank.

Relative to the introduction of a multiplying lever in the Walschaert gear of some recent Atchison, Topeka

& Sante Fe engines, I state a preference for a large link, the chord of the arc of which is long, in connection with an eccentric of large radius. In this multiplying lever arrangement, the link arc is struck from the center of the intermediate pin while the multiplying lever is neutral.

In the July, 1930, issue, page 423, you published a table of lead values of some Illinois Central engines wherein there is variable lead, i.e., "crossed lead" obtained by employing a suitable length and position of return crank.

HARRY CORNELL.

Does It Pay to Reclaim?

TO THE EDITOR:

The editorial entitled "Does It Pay To Reclaim" appearing in the September issue of the *Railway Mechanical Engineer* prompted me to conduct some extensive investigations along these lines in several of the shops which I visit frequently.

Having always been an advocate of reclamation I must admit that I was somewhat surprised to find that some of the parts which were being reclaimed were costing considerably more than it would have cost to buy new.

At the tin shop, such articles as the engineman's torch, trainman's lantern, spout oil cans, car inspector's carbide lamps, tin cups, buckets, etc., were being repaired. One mechanic and a helper, their combined rate of pay being $1.38 per hr., were engaged in this work. It was not difficult to see that the cost of soldering up a few holes and replacing the handle on a spout oil can consumed about ½ hr., and cost about 69 cents, while a new can costs but 48 cents at the store room. Trainmen's lanterns, costing $1.27 and car inspector's carbide lamps, costing $4.96 at the store room can be repaired for a great deal less than their new value, provided, of course, they are not too badly damaged. However, I found that very little saving could be effected in the reclamation of enginemen's torches, tin cups and other miscellaneous items; in fact the cost of reclamation, in most instances, exceeded the original cost.

There are many parts which are sent to the welding shop to be built up or electrically welded. An exhaustive study of actual costs for performing this work when compared with the first cost of the article proved that it did pay to reclaim by the electric welding process. As an example, 12 5½-in. by 10-in., truck side frames can have the worn surfaces at the column slide built up or the cracks in the compression members welded by one 80-cent an hour mechanic each eight hours. The cost of this welding, including labor and material, will average but 56 cents a frame and compared with $31.80, the price of a new truck frame, will show a saving of $31.24 for each frame.

Worn Type D coupler knuckles, costing $5.20 each, can be built up by electric welding for 80 cents each, thereby effecting a savings of $4.40 on each knuckle, the cost of dressing the welded part on the emery grinder being included. Knuckle locks can be welded at an average cost of 65 cents each, including dressing—a saving of 87 cents each over the new cost.

Electric welding applied to air-brake cylinders and reservoirs in the air-brake shop is economical also, provided not more than two build-ups are permitted. A welder can apply 12 lugs to reservoirs or cylinders in eight hours at a total labor and material cost of $7.48 and taking into consideration that the price of one of these parts is $5.20, a saving of about $23.00 per day can be made.

Couplers with bent bodies or those having the guard arms or face bent out of contour can be heated in the blacksmith shop and re-set to contour or the bodies straightened at an average cost of $2.00 each. Compare this cost with the new price of an A.R.A. Type D coupler, which is $21.50.

The figures as shown in your editorial, regarding the cost of reclaiming brake beams are just about right and I will not attempt to dispute the fact that if reclaimed brake beams are used on foreign cars they will represent a loss of money to the railroad company which reclaims them. However, if repaired properly, a reclaimed brake beam should give equally as long service as a new one. The principle parts which require renewal are the brake heads and in the majority of cases these are worn out due to the failure of car inspectors and repairmen in not detecting worn out or missing brake shoes. If reclaimed brake beams are used exclusively on system cars at a saving of $1.80 for each beam so used, I believe it pays to reclaim them.

On the other hand, it should be understood that the railroad company must furnish new brake beams for application to foreign cars, as the car owner can be billed for the full value. It is certainly false economy to apply any reclaimed or second hand part to a foreign car when a new item can be applied and the car owner billed for it.

Reclaimed and second-hand material should be used only on system cars as it is the difference between the new and second-hand price of the material which furnishes the basis for figuring the amount saved in reclamation.

A thorough investigation enables me to answer the question "Does It Pay to Reclaim" in both the affirmative and negative. It does pay to reclaim some parts and it does not pay to reclaim other parts. The only way for the general foreman or superintendent of shops to answer this question is by making a comprehensive study of the parts being reclaimed and the conditions under which the work is done, taking into consideration the use that is made of the article after it has been repaired.

H. K. ALLEN.

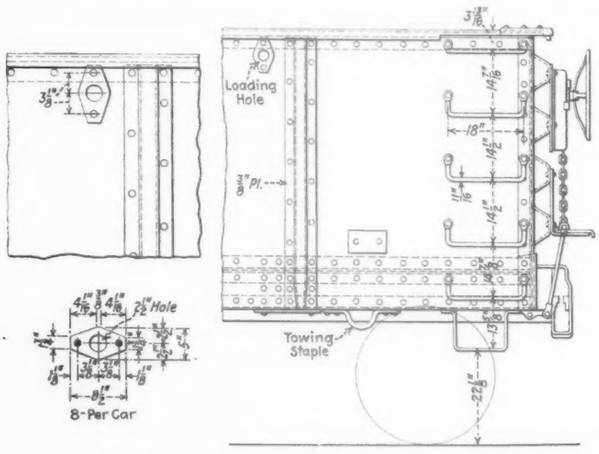
* * *

Card room on one of the cars of the "Banner Blue Limited" of the Wabash

With the Car Foremen and Inspectors

Loading Holes and Towing Staples on Open-Top Cars

THE Central of Georgia has had in service since the first of the year 500 all-steel solid-bottom gondola cars in the construction of which several features to facilitate the loading of cars and the towing of cars around manufacturing plants have been incorporated. These cars, which were built by the Pullman Car & Manufacturing Corporation at its Bessemer, Ala., plant,



Drawing showing the location of the loading holes and towing staples

have an inside body width of 9 ft. 5⅛ in. and an inside length of 42 ft. The height of the sides, inside, is 4 ft. 8 in.

It will be noted from the photograph of the car, that there are four holes in the side directly under the top side angle. These holes, which are 2½ in. in diameter and are reinforced with $\frac{5}{16}$-in. plates, are for tying chains and ropes to facilitate loading. Loggers and other shippers handling heavy material at improvised loading points frequently cut holes in the cars in which to tie chains or ropes when loading. Since these cars were placed in service, the railroad has received sufficient favorable comment to incorporate this feature in the design of gondola cars and recently duplicated the first order of 500 cars. It now has a total of 1,000 gondola cars provided with loading holes now in service.

In addition to the four loading holes in each side of the car, forged towing loops or staples are riveted to the under side of the side sills about 3½ ft. from each end. These staples were applied after the first order of cars were built and do not appear on the car shown in the illustration, but are shown in the drawing. They are forged from 1¼-in. round stock with a loop of about 3-in. radius, inside, and each one is secured to the side sill with four rivets. This location of the staples places them near the center of the trucks.

The railroad has requested its shippers to use these staples in towing cars about their plants instead of fastening chains to steps, grab irons and other fixtures. This feature, it is believed, will eliminate considerable damage to the safety appliances which have been commonly used for towing purposes.

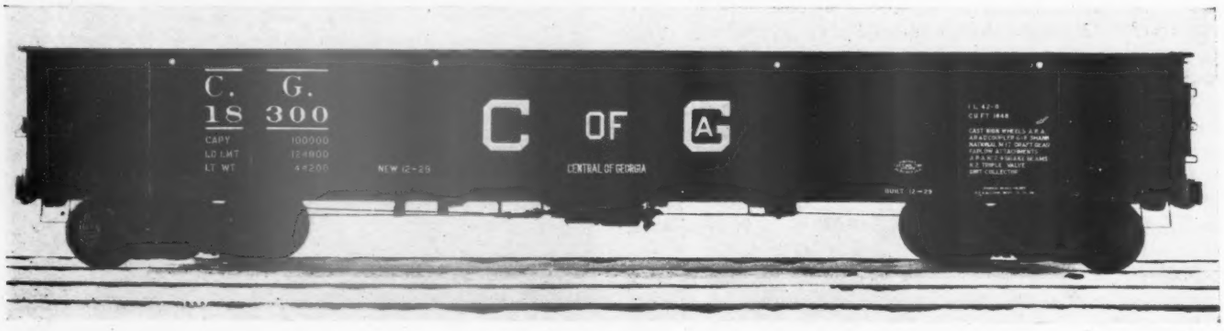
Tool For Removing Old Dust Guards From Journal Boxes

OLD dust guards can be removed from journal boxes in from 30 to 45 seconds if the tool shown in the illustration is used.

A piece of tool steel ¾ in. by 1½ in. and 36 in. long, shaped to conform to the contour of the bottom of the journal box and having the shaped end drawn out to a chisel edge is all that is needed.

With an ordinary hand chisel and hand hammer the top section of the dust guard can be removed with little difficulty. Then by inserting the tool in the side of the journal box the old dust guard will collapse toward the center of the box and can be removed in one piece. An air hose to which a ⅜-in. nipple has been attached will remove all small particles of waste etc., and the new dust guard can them be applied.

The use of this tool will be found advantageous in



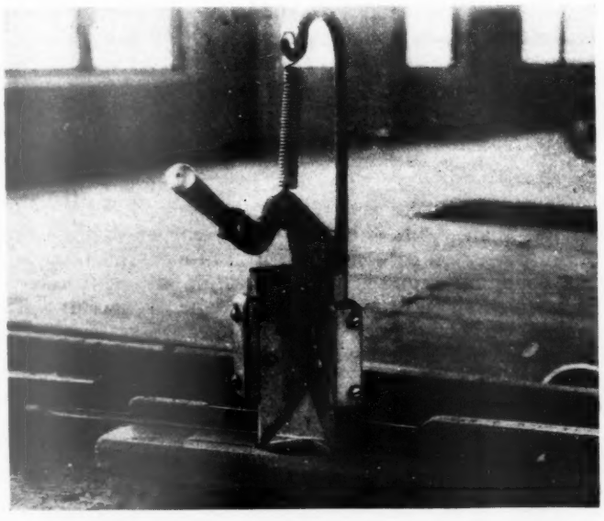
Central of Georgia gondola cars provided with loading holes—The towing staples were not applied to this car until some time after this photograph was taken

This tool will remove old dust guards in 45 sec.

car shops where trucks are rebuilt, especially where the work is done by designated truck repairmen who must have the trucks completed in time to move the car at timed intervals.

Shear for Wood Moulding

THE hand shear shown in the illustration was designed for cutting small wood moulding for sashes, doors, windows, etc. The cutting is done by two steel knives which are 6 in. long from the point to the



The shear cuts a true 45-deg. angle in moulding

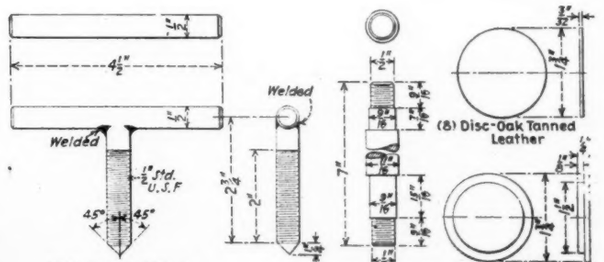
heel with the edge sloping sharply from the point at the front. The knives are attached by set screws to a 6-in. section of 3-in. by 3-in. brass angle, which acts as a slide and which is attached in turn to an 18-in. operating handle. The brass slide moves vertically in two brass guides which are secured by means of set screws to the edge of a steel angle welded to a flat base of ½-in. plate. A triangular 2-in. opening in this plate allows for the passage of the knives.

The operating handle is hinged to a projection welded on the back edge of the steel base and to the middle of the brass angle to which the knives are attached. The knives are suspended from an upright section of rod by a ½-in. coiled spring and are pulled down to make a cut. The shear is mounted near one end of a 3-ft. section of a 2-in. by 6-in. board. A section of a 1½-in. by 1½-in. board is nailed along one edge of the upper surface of the long end of the 2-in. by 6-in. board and is graduated for use in measuring the length of moulding to be cut. The shape of the knives makes a proper cut for a right-angle joint.

Testing Emergency Valve Seats and Valves

THE fixtures and tools for testing the emergency valve seat and valve can be used to advantage in the air-brake repair department, inasmuch as a triple emergency valve and seat may be tested before being placed on the test rack. The detection of a defective valve or seat will eliminate the necessity for the removal of the check case from the triple valve after being placed on the rack.

The numbers shown on the assembly drawing of the fixture refer to the part numbers on the drawing show-

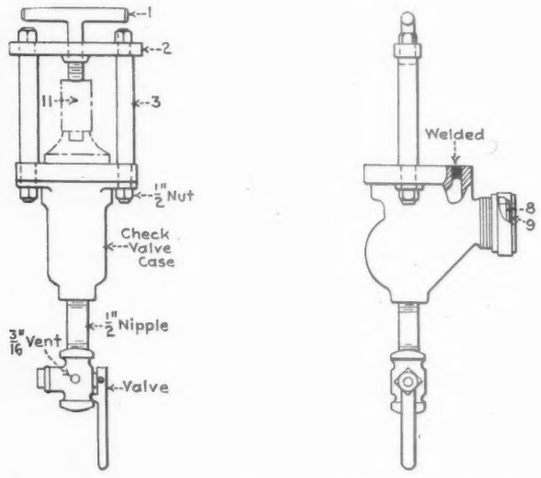


Details of the fixture for testing emergency valves

ing the detail parts. The screw handle (1) is made from a hardened scrap drill rod. The yoke (2) and post (3) are of machine steel finished all over. The yoke nuts (4) are ½-in. hex., requisitioned from stock, and threaded 13 threads per inch. The nipple (6) is a ½-in. wrought-iron pipe, cut and threaded 3 in. in length. The valve (7), which controls the supply of air from the shop air line, is a ½-in. Westinghouse cut-out cock. Oak-tanned leather is used for the disc (8), while the shoulder disc (9) is of brass.

The test plugs, (10) and (11), are made from hard-

ened scrap drill rods. They are applied to the check-valve case, as shown in the assembly drawing. When testing, the check-valve case portion of the triple valve, emergency piston, valve seats and valves are removed and the fixture is applied, as shown. These parts are inspected and repairs made on the bench. The leather



Fixture for testing emergency valve seats and valves

disc (8) is substituted for the rubber seat. The shoulder disc (9) is placed on top of the disc (8), and fits in the lower opening in the emergency-valve seat. The test plugs hold the discs against the air pressure, but at the same time permit the discs to fit against the valve seat. Any imperfections in the seat will show up when air leaks past the discs.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Responsibility for Lading Adjustment

The chief joint inspector in charge of the interchange between the Western Maryland and the Reading issued Western Maryland transfer and adjustment orders to the Reading for the adjustment of poles not loaded in accordance with A. R. A. loading rules. A bill was rendered by the Reading, November, 1925, in the amount of $994.32.

The Reading was unable to obtain settlement of the bill. The Western Maryland as plaintiff, per Rule 123, failed to prepare an agreed statement of facts. The Reading submitted its statement for decision by the Arbitration Committee based on the argument that a transfer or adjustment order once issued bears the same relation as to its responsibility as a defect card for which various decisions have been rendered.

The chief joint inspector has full authority in the matter as conveyed by a special agreement between the Reading and the Western Maryland effective November 16, 1920, covering interchange between the two companies, section 3 of said agreement reading as follows:

"The chief joint inspector shall have supervision over all matters pertaining to this interchange of cars, which shall be in accordance with the prevailing American Railway Association (mechanical) rules for the inspection of cars and lading, and will issue defect cards, transfer or adjustment authorization against the companies responsible for the forwarding of defective cars, as well as cars improperly loaded, when in his opinion the forwarding line does not comply with the rules."

The Arbitration Committee rendered the following decision: "The interchange agreement between the Western Maryland and the Reading does not conflict with the Interchange Rules. Both roads have agreed to be governed by the decisions of the chief interchange inspector whose decisions shall be based on the interchange rules. The chief interchange inspector states that the loads had shifted and did not comply with the requirements of the A. R. A. loading rules, thus making readjustment necessary.

Accordingly, the Western Maryland is responsible. *Case 1643—Ex-Parte Case—The Reading Company.*

Tank Car Damaged in Switching

While being switched on the tracks of the Michigan Central at Waterford, Ont., December 21, 1928, Grasselli tank car No. 68 owned by the Canadian Industries, Limited and loaded with 109,900 lb. of 66-deg. sulphuric acid, burst the A-end tank head, resulting in the loss of the entire contents of the car. The fracture extended diagonally from right to left across the tank head for a length of 82 in. Samples of metal cut in the line of fracture revealed that the tank-head thickness was $\frac{5}{16}$ in. at the bottom and ½ in. at the top.

The Canadian Industries, Limited, requested a defect card for the damage to the car. The Michigan Central declined to furnish it on the grounds that the car was not subjected to unfair usage. The Michigan Central contended that in addition to the corrosive effects that occurred on the interior of the car, the exterior of the tank head in the immediate vicinity of the line of fracture also showed extensive wear and serious pitting of the metal caused by the use of head-block anchorages.

The following is the decision as rendered by the Arbitration Committee: "The evidence submitted, including photographs, indicates that the fractured head, which was less than $\frac{7}{16}$ in. thick, showed signs of distress at bottom by reason of contact with head-block anchorage. This condition requires the application of reinforcing shoes which should have been used when achorage was changed, in compliance with tank car specifications. Therefore, under the exceptions noted in third paragraph of Rule 32, car owner is responsible. *Case No. 1645—Canadian Industries, Ltd. vs. Michigan Central.*

Insufficient Information Concerning Damaged Car

On August 11, 1928 the Jersey Central advised the Harris Abbattoir Company that its car No. 108 was at the Elizabethport shops of the Jersey Central with deteriorated and buckled center sills and requested the owner to authorize repairs or to furnish disposition of the car. The car owner was advised that the damage was the result of ordinary service and that the estimated cost of repairs was $115.

The Jersey Central never furnished a statement showing exactly how the damage occurred as required by Rule 44. The car owner refused to authorize repairs to the car, but informed the Jersey Central to repair the car and render an invoice for the work, stating that if the invoice was properly supported by a statement as required by Rule 44, the bill would be accepted. The railroad refused to repair the car without authority and the car owner, needing the equipment, finally authorized the work at their expense contending that the authorization was virtually forced upon it. The Jersey Central submitted a joint inspection certificate covering the damage to the car which was signed by two Jersey Central inspectors. The repairing line contended that the combination of defects was the result of ordinary wear and tear and that the car owner was responsible.

In rendering a decision the Arbitration Committee stated that "The Jersey Central failed to furnish statement showing the circumstances under which damage occurred (to establish owners' responsibility), which is a definite requirement of Rule 44. In the absence of such statement, the Jersey Central is responsible for the damage. Decisions rendered in Arbitration Cases 1529 and 1560 are parallel" *Case 1646—Harris Abbattoir Company, Limited, vs. Jersey Central.*

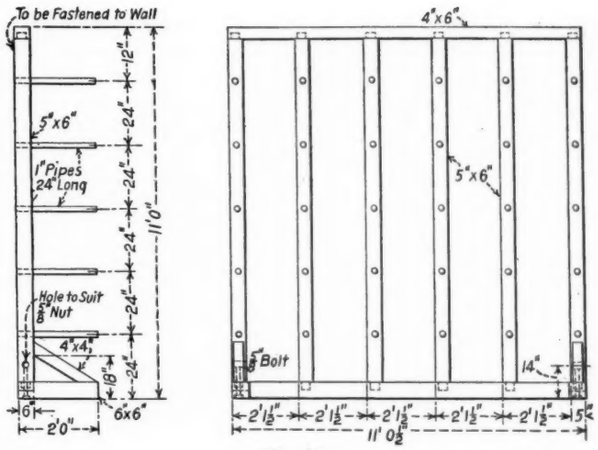


Fig. 2

Fig. 2 is a rack designed to be secured to a wall. The templates are separated by 1-in. pipes, 24 in. long, spaced as shown. The rack occupies a wall space of 11 ft. by 11 ft. ½ in. Fig. 3 is a rack of similar design, but constructed for template storage on either side.

Three Racks for Storing Templates

THE racks shown in the three drawings are standard on an eastern road and are designed for the storing of templates used in the plate or forge shop. Referring to Fig. 1, this rack is built in four different sizes, of which the dimensions for one are shown. The

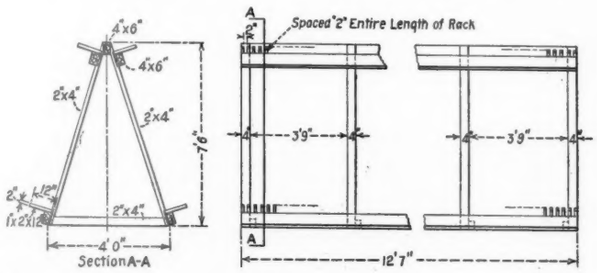


Fig. 1

rack is entirely of wood construction. The templates are kept separate by 1-in. by 2-in. by 12-in. strips spaced 2 in. apart as shown. They are placed on the rack in a sloping position, the upper portion of the template lying against the 4-in. by 6-in. top piece.

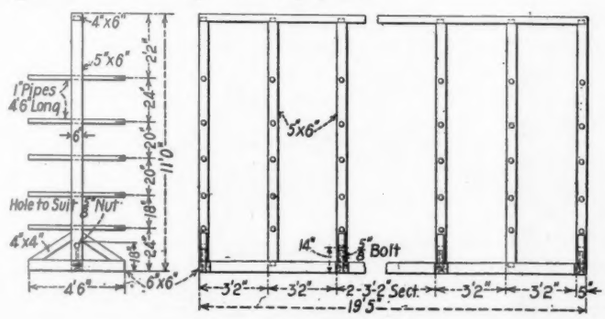
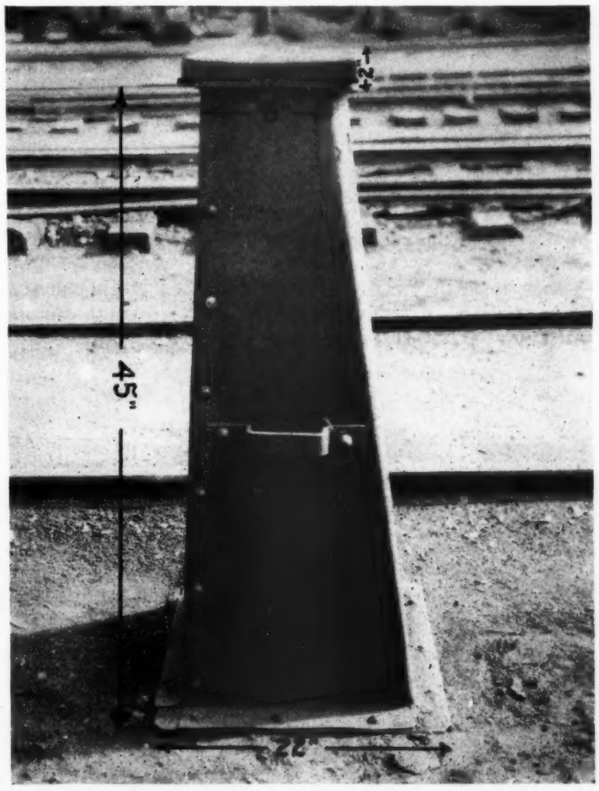


Fig. 3

Wood Car Trestle Replaced by One Built of Steel

WOODEN trestles have long been considered the standard for use in car repair shops and on rip tracks. However, the high cost of maintenance and



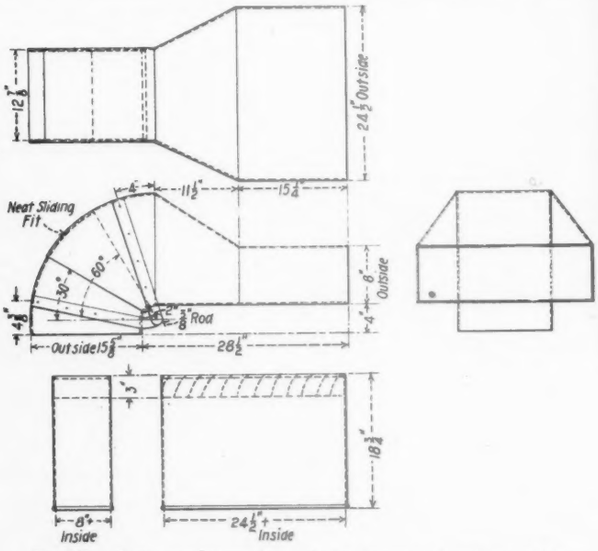
Steel-plate construction provides a neat and safe support for car bodies

their unsightly appearance prompted a car foreman to design one of steel construction which is shown in the illustration. The trestle is formed from a single sheet of 3/16-in. steel 50 in. by 72 in. flanged on one side and at the top and bottom. A ½-in. steel plate is riveted at the top and bottom after the side has been either electrically welded or riveted. Four ½-in. holes are provided in the flanges of the top plate in order that a 2-in. by 12-in. by 12-in. oak block can be attached to the top of the trestle at the point where the car or load rests.

The weight of the steel trestle is less than that of the wood type and the only maintenance cost is that of renewing the oak block on top as it becomes worn or damaged from use.

Cooling the Air in Sleeping Cars

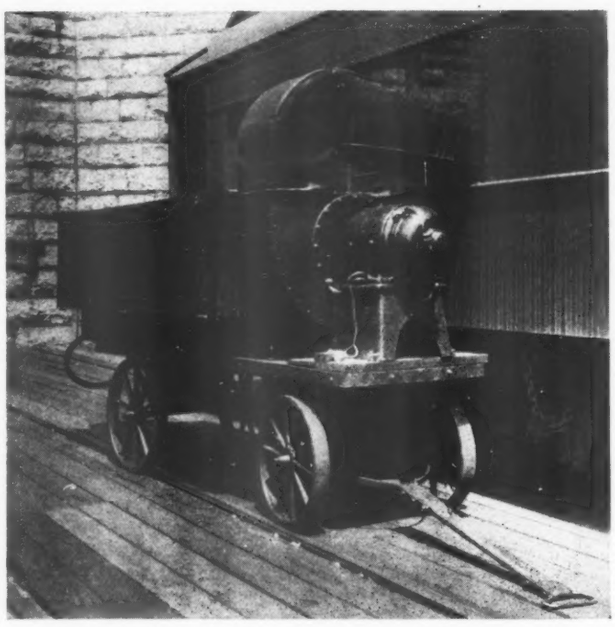
HOT weather makes sleeping cars that have been standing in coach yards or stations all day extremely uncomfortable until late in the evening and the atmosphere in the cars has been cooled while the train is in motion. Frequently, especially during the summer months, passengers wishing to retire early complain because of such conditions. To overcome this difficulty, the Baltimore & Ohio developed a car-cooling device, for which it has patents pending, that was used successfully during the past summer for cooling sleeping cars standing in passenger terminals.



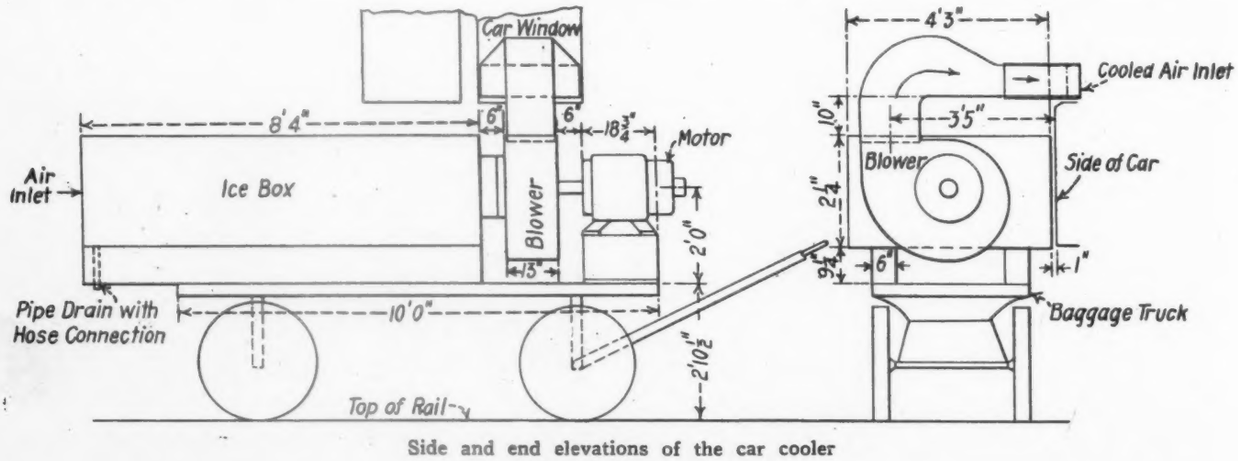
Details of the construction of the louver-closed conduit

The "cooler" is carried on a four-wheel baggage truck, and can be easily moved from place to place. It consists essentially of an ice box, blower, electric motor and air inlet duct with louver, which is inserted through an open window in the passageway of the car.

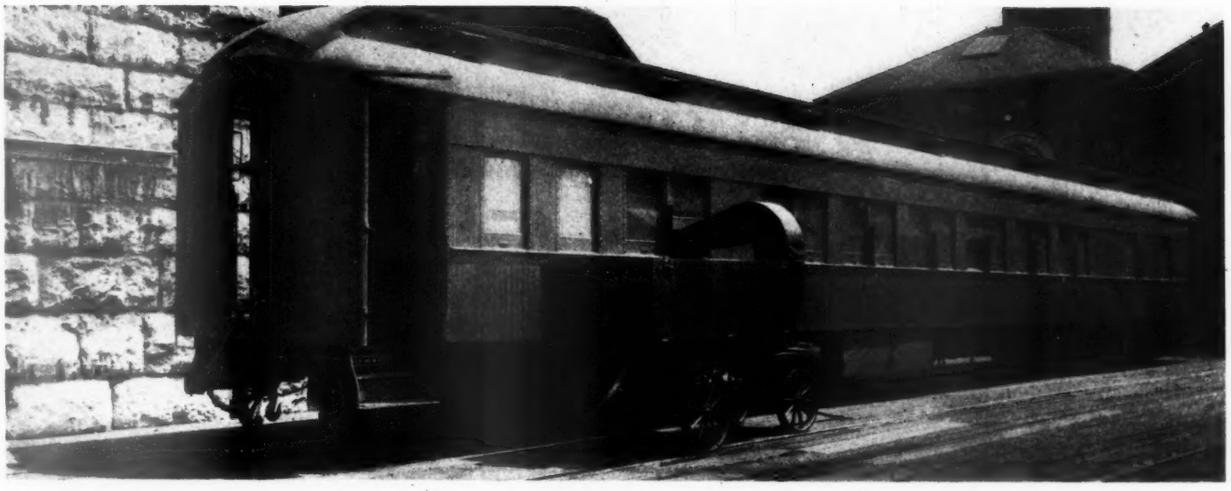
The blower operates at a pressure of one ounce and has a capacity of 2,500 cu. ft. per min. It is operated by a 1¾ h.p. motor at 1,750 r.p.m. Air is drawn in through the opposite end of the "cooler" over six cakes of ice that are placed in the six compartments of box, the partitions of which have openings 3 ft. 2 in. near the bottom to insure full circulation of air over ice. The air inlet is covered with 24-mesh copper screen and is 2 ft. 6 in. wide by 10 in. high. The box is 1 ft. 11½ in. by 3 ft. 11 in. by 8 ft. ¾ in. inside, and is loaded with cakes of ice through side drop hinged door opening, 1 ft.



Front view of the car cooler showing the louver and blower application



Side and end elevations of the car cooler



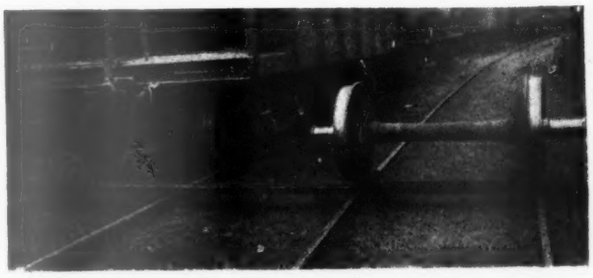
Cooling the air in a sleeping car standing at a station—The exhaust fan is in the fifth window from the far end

11½ in. by 8 ft. ¼ in. It is made of No. 24 galvanized iron and is insulated with one inch of cork. The louver is also made of No. 24 gage galvanized iron, with an 8 in. by 24½ in. adjustable nozzle leading into the car. It can be reversed to throw the air in either direction, right or left, as desired.

The air is exhausted from the car by means of an exhaust fan which is placed in a window at the opposite end of the passageway.

Handling Car Wheels

HOW many men does it require to skid a pair of wheels from the supply track to the car-repair track? Usually from four to six men are needed if the conventional round iron skid is used. In addition to this



A car wheel placed on the skid and ready for movement from the supply track to the repair track

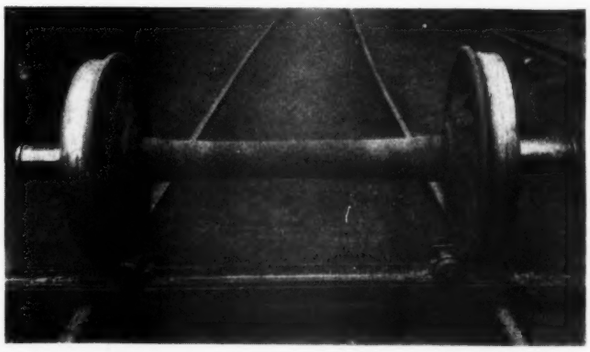
it is also necessary to saturate the surroundings with oil in order to make the skid slide over the rails freely.

With the wheel skid shown in the illustrations the wheels can be easily handled by two men. The rails and surroundings need not be oiled because, after the wheel has been rolled on the skid, a carriage which can be moved by one man delivers it to the car-repair track on which it is needed.

This device is made in two sections—an eight-inch channel 18 ft. long (longer if track centers are greater) serves as the runner from the supply track to the car-repair track. A six-inch channel 5 ft. 8 in. long to which four 3¼-in. diameter flanged wheels have been mounted provides the carriage. These wheels roll on the edges of the flanges of the 8-in. channel and support the 6-in. channel free from contact with the larger channel.

Two wedge shaped blocks, either hard wood or steel, are placed on the rail to facilitate rolling the wheels on to the carriage.

The wheel skid can be lifted by two men and carried



A close-up view of the carriage just before the car wheel has been placed on it

to any point desired or it can be moved at the same time that the wheel is taken away merely by placing the skid in the center of the axle, one man holding on to one end while the wheel is being moved.

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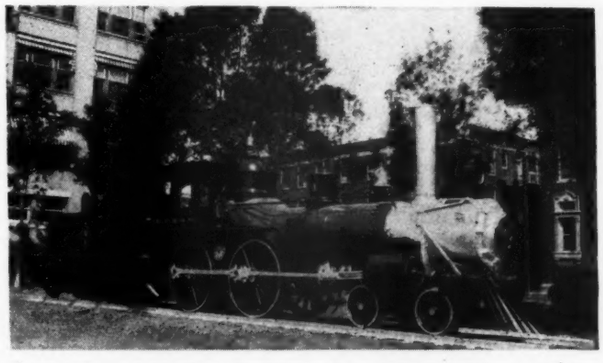


The original E. P. & S. W. locomotive

In the

Back Shop and Enginehouse

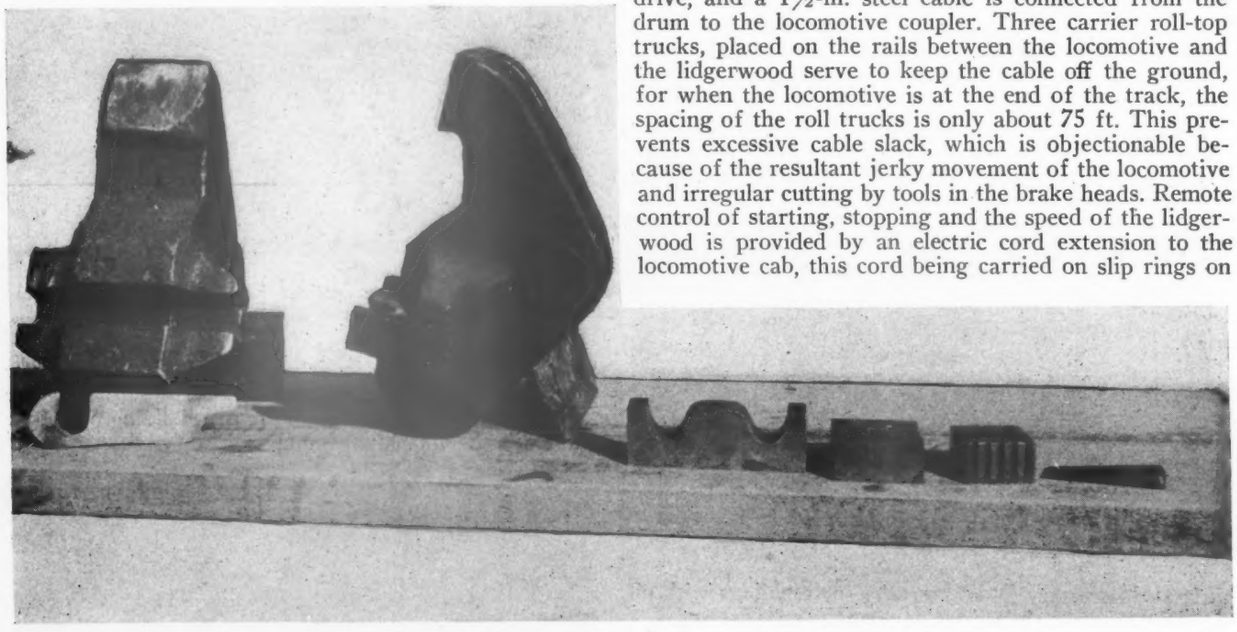
Turning Tires without Removing the Wheels

IN former years, when locomotives were used much less intensively, hauling lighter trains at slower speeds than at present, the amount of tire wear was usually the governing factor in determining the length of the shopping period. Locomotives were taken in the shop, driving wheels removed, tires turned in the wheel lathe, machinery given general repairs and necessary boiler work done. With motive power operating under modern conditions, however, the tires frequently reach the federal limit of wear, or the limit of flange height, before the rest of the machinery is in need of general repairs. Consequently, there is a distinct field in locomotive maintenance operations for some satisfactory method of turning tires, with the driving wheels in place under the locomotive, thus saving the labor cost of unwheeling, as well as a considerable amount of locomotive out-of-service time, which is an increasingly important factor with modern power.

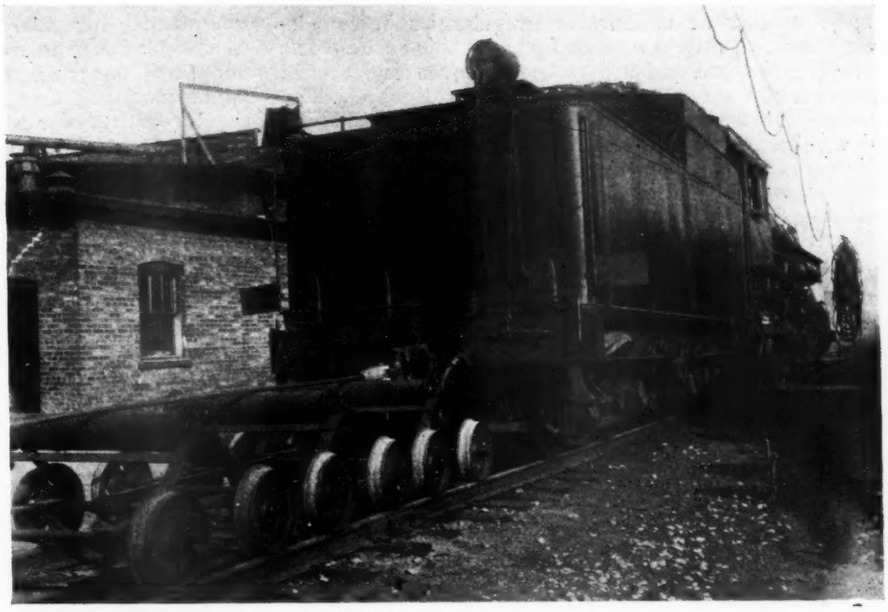
A general method of accomplishing the desired result by using dummy brake heads equipped with cutting tools and moving the locomotive, with a limited amount of pressure in the brake cylinders, has been in use for several years on quite a number of roads, such as the Baltimore & Ohio, the Pennsylvania, the Northern Pacific, the Soo Line, the Chicago Great Western and the Chicago, Milwaukee, St. Paul & Pacific, to mention only a few. The present article will be devoted largely to a description of how the tire-turning operation is handled on the Milwaukee, with a limited reference to the somewhat more complete method of tooling used by the Northern Pacific.

A few principles seem to have been established as a result of experience on the Milwaukee; namely, that the method of tire-turning without unwheeling is practicable, accurate and economical; that locomotive out-of-service time is reduced; that tire service metal is conserved, owing to the correction of sharp flanges before excessive wear develops; that an outside source of power for hauling the locomotive is absolutely essential to uniform cutting; that maximum advantages cannot be achieved unless properly-ground cutting tools are applied to turn all tires simultaneously, and that it is inadvisable to attempt to carry on the operations at outlying points not furnished with the proper equipment and experienced operators.

On the Milwaukee, power for hauling locomotives during the tire-turning operation is provided by an old lidgerwood, suitably housed at one end of a 300-ft. stretch of straight, level track. The machine is installed on a concrete and pile foundation to prevent shifting. A 50-hp. electric motor replaces the old steam-engine drive, and a 1½-in. steel cable is connected from the drum to the locomotive coupler. Three carrier roll-top trucks, placed on the rails between the locomotive and the lidgerwood serve to keep the cable off the ground, for when the locomotive is at the end of the track, the spacing of the roll trucks is only about 75 ft. This prevents excessive cable slack, which is objectionable because of the resultant jerky movement of the locomotive and irregular cutting by tools in the brake heads. Remote control of starting, stopping and the speed of the lidgerwood is provided by an electric cord extension to the locomotive cab, this cord being carried on slip rings on a steel-wire suspension line reaching the entire length of the 300-ft. track. The electric cord runs out quite easily, one loop at a time, in forward movement of the locomotive by attachment of the cord through the cab window, but on the back-up movement, when all, or a large proportion, of the loops must be moved at one time, this is accomplished by a small rope extended from the forward ring to the rear of the tender.



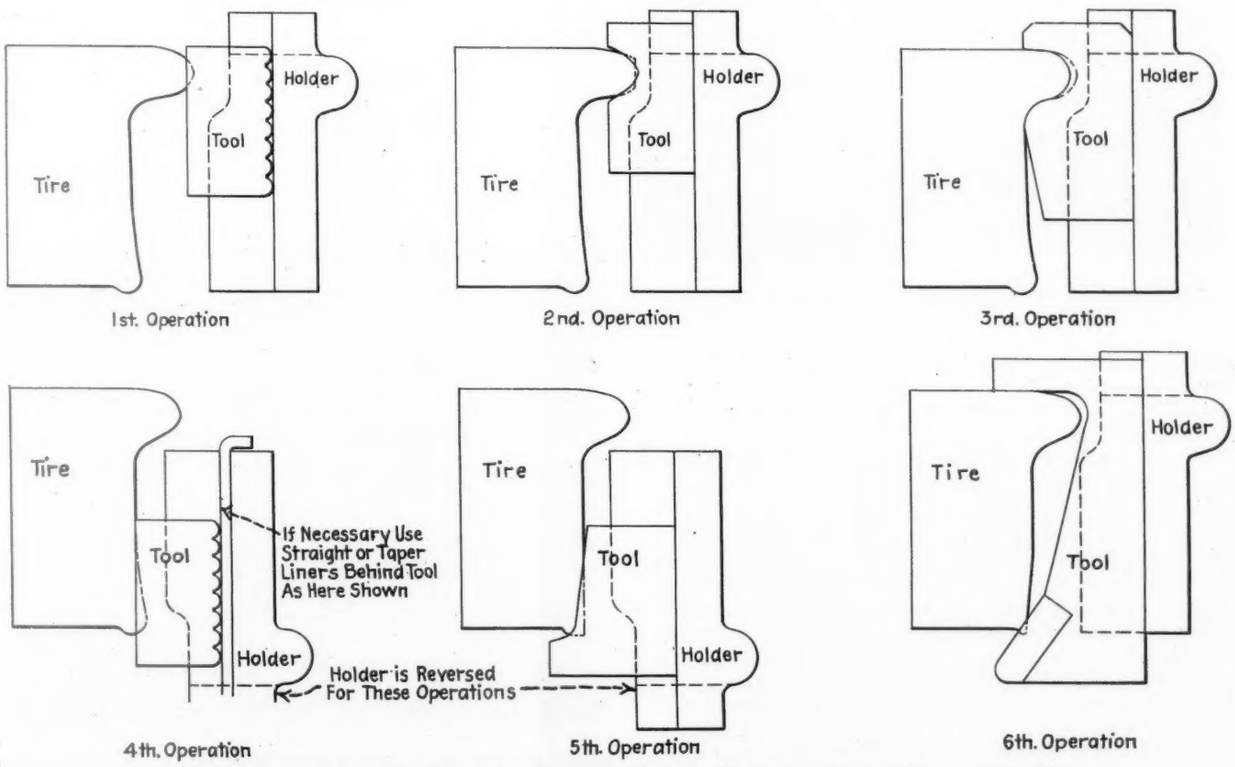
Cast-steel brake tool heads, cutters and straight and taper key used in tire turning



Milwaukee locomotive coupled to the lidgerwood cable.. The electric remote control cord is shown at the right

Tooling equipment for the tire-turning operation includes a set of cast steel tool holders similar to the driver brake heads except that slots are provided for the cutting tools of special high-speed steel backed up by straight or taper keys as may be required to give the correct cutting angle. Only three tools are used in the Milwaukee practice. These are a grooved roughing tool, a straight finishing tool and a flange forming tool, all of these being interchangeable for use on either the right or left side of the locomotive. No clamping device is necessary to hold these tools in the heads during the operation. Tool clearance is controlled by the insertion of blocks or spring steel clips of the proper thickness between the upper part of the tool head and the bearing on the tire.

Only one machinist and one helper are required to turn locomotive tires by this method, the helper being located in the cab where he can take signals from the machinist, control the speed of the locomotive, keep the right amount of air pressure in the brake cylinders, etc. Before undertaking to turn the tires, however, the brake equipment and rigging is carefully checked to make sure that all parts are in good working order and equal pressures delivered to all driving wheels. (A surprisingly



Six operations involved in tire turning on Northern Pacific locomotives without unwheeling

large number of undesirable irregularities in foundation brake rigging have been found by this check.) The brake shoes and heads are then removed and special heads with the required tools applied to all wheels. The locomotive is operated under its own power 300 ft. down the track by the machinist. The helper then takes charge in the cab, applying the air brake and controlling the lidgerwood machine speed and the back-up movement of the locomotive, in response to signal indications from the machinist on the ground who is watching the progress of the tire turning. The speed of the locomotive and consequently the tool cutting speed is 25 ft. per min. About 15 lb. pressure is maintained in the brake cylinders, although this can sometimes be increased without sliding the wheels, if the tools do not seem to be cutting fast enough. Grooved and straight cutters are used alternately on both the top of the flanges and the outside of the treads until the proper amount of metal has been removed. The flange-forming tools are then applied and the job finished, the total operation taking from six to eight hours.

The success of the operation on the Milwaukee is perhaps due, more than any other one thing, to the

Set-up of the brake tool head and cutter when machining the outside taper of the tire

selection of the proper tires to be turned. All tires are carefully calipered before turning, and checked for roundness with a ball-center gage. Obviously, this method of machining cannot be expected to correct tires badly out of round on the tread. Neither does it pay to turn all tires down to the diameter of one pair which may be worn to an unusual extent. If one or two tires are undersize, they are changed and larger ones applied, thus saving considerable wear metal. Throughout, and at the conclusion of, the tire-turning operation the tires are checked with calipers for diameter and with a ball-center gage to assure roundness. The Milwaukee has been carrying on this practice for practically three years, 48 sets of locomotive tires having been turned in 1928, 97 in 1929 and 93 up until November 18, 1930.

Northern Pacific Practice

On the Northern Pacific, which has been following this practice for nearly five years, similar equipment is used for keeping the flanges and the portion of the tires outside of the tread turned down to within reasonable limits until such time as it becomes necessary to shop the locomotive for general repairs and remove the drivers for turning in a wheel lathe. No attempt is made to turn the tires of passenger power by this method, nor are the treads turned or trued on any class of power, except in a wheel lathe.

The tools and operations used by the Northern Pacific are shown in the drawing. The first operation consists

View showing the locomotive in its extreme position with the three cable carriers spaced about 75 ft. apart

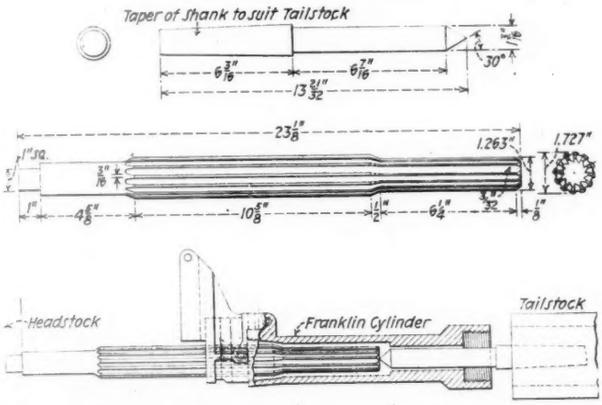
of cutting down the high flange, using the rough (grooved) and finish edges of the tools alternately, as required. The flanges then roughly formed with the tool shown in the second operation, and finished with that in the third. In the fourth operation, the high spot on the tire outside of the tread is removed, using alternately the rough and finish edges of the tool illustrated. Hard spots are removed with a pneumatic grinder. In the fifth operation, the taper is cut on the outside of the tread and, in the sixth, any ragged edge which there may be on the corner of the tire is cut off.

Reamer for Franklin Fire-Door Cylinder

THE constant use of a Franklin fire-door cylinder causes it to become worn on one side, rendering it difficult to make an air-tight fit of a new piston when turning and fitting it in the cylinder. This difficulty is accentuated because the pistons do not have rings. The cylinders being bored to two sizes; i.e., with an offset, present a problem to the mechanic when he reams or bores the cylinder, because the two bores must be in line with each other if the piston is to be made to work freely and still hold air. The reamer shown in the illustration is designed to insure the accurate boring of this offset cylinder.

When in use the reamer is driven with a lathe dog on the headstock end of the lathe, the reamer being placed into the cylinder and set on the centers, the tailstock center being of special design to fit smaller bore. The offset of the cylinder is placed in front of the tool post of the lathe, the lathe carriage feeding it in. The

reamer should not be run too fast, and oil must not be used while reaming. The reamer should be made of



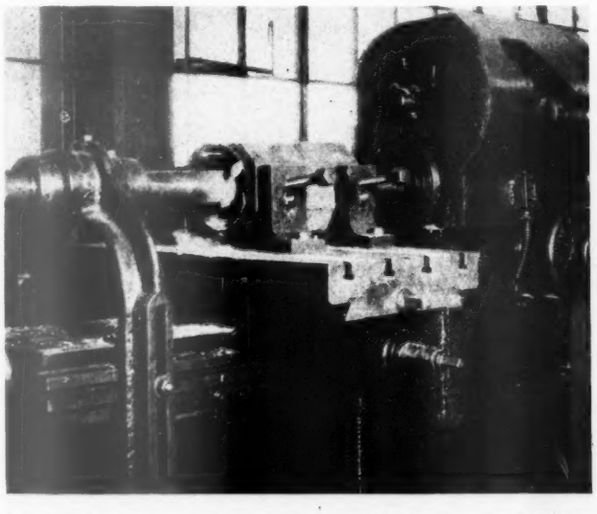
The reamer is designed to ream both the cylinder and the offset at the same time to insure the alinement of the two bores

high-speed steel and unless hardened by an expert, it should be left at least 1/32 in. oversize for grinding as it will warp to some extent because of the length with which it is necessarily designed.

Production Fixtures for Boring Journal Brasses

FIXTURES for facilitating boring operations on trailer-truck journal brasses, engine-truck brasses, oil cellars for engine-truck boxes and driving-box cellars are shown in the illustration. The fixtures, of which there are two, are adjusted to suit the length of the work to be bored and are clamped to the table of the machine with bolts. They are held parallel with each other by tongues machined on the base of the fixtures which fit the slots in the machine table.

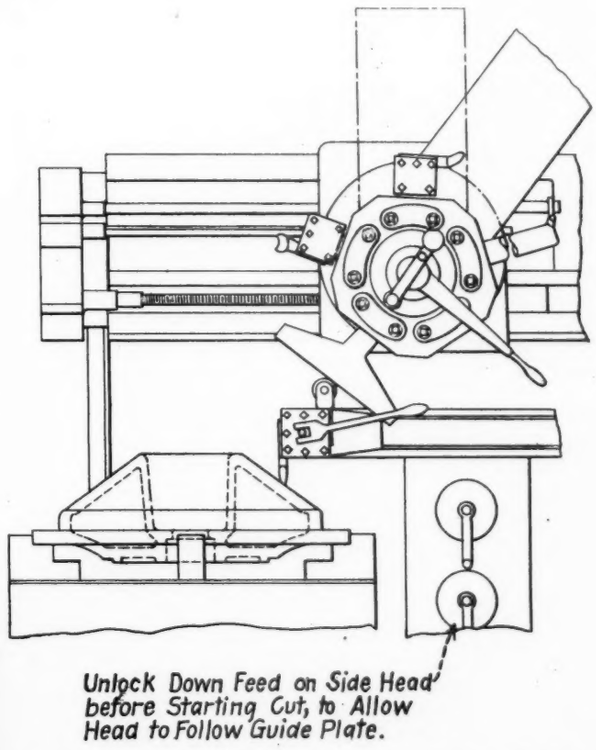
The work is clamped in the fixtures by conical-pointed set-screws which are set at an angle to exert a downward pressure on the work. There are three holes for the set screws in each of the four upright members of the fixtures between which the work is held. These holes are located at different heights from the bottom of the fixture in order to accommodate journal brasses of different sizes. After adjusting the fixtures and the machine table for one job, any number of similar journal brasses may be lined up properly simply by loosening and tightening the set screws.



Journal brasses can be bored on a production basis with the aid of the fixtures

Attachment for Facing Locomotive Cylinder Heads

DESIGNS of cylinder heads vary to a considerable extent, but in the majority of cases there are broad surfaces to be finished which require at least 6 hr. floor-to-floor time. The taper attachment, shown in the drawing, is used by an eastern road for facing cylinder heads, of the type shown, on a Bullard turret lathe. The horizontal and vertical feeds are used in combination. A



Taper attachment for facing cylinder heads on a Bullard turret lathe

guide plate is inserted in the head instead of a cutting tool. The correct inclination of the guide plate is obtained by using a protractor on the turret head, which is adjusted so that the face of the guide plate is parallel to the surface to be finished on the cylinder head, thus insuring an accurate set-up.

A roller is attached to the cutting-tool fixture on the horizontal feed which regulates the angular movement of the cutting tool to correspond with the angle of inclination of the guide plate. The vertical feed is free to adjust itself to the guide plate.

*Drop and Machine Forging**

By S. Lewis
Canadian National, Winnipeg, Man.

AN interesting example of bending work in making coupler yokes on a hydraulic bulldozer is shown in Fig. 1. The actual forming of the yoke is done in two operations in one heat. The die body may be considered a universal one for this particular job. It is designed to bend any kind of a yoke used on the system by substituting interchangeable parts developed for this purpose. The die is comprised of an upper and lower deck. The first operation is performed on the upper deck; the material is placed to a gage against the rollers of the bending arms; on the forward movement of the arms the material is bent into a U shape, then the yoke is lifted by an air hoist, reversed and lowered to the bottom deck; the forming die is again brought forward and the lips are formed and all surplus stock sheared off. In the forming of the lips an arm on either side of the yoke is brought in contact with the metals by means of a wedge-shaped arm extending forward from the crosshead; these arms force the right and left forming arms to close tight against the metal thus forming the lips.

* Abstract of paper presented at the thirty-fourth annual convention of the International Railroad Master Blacksmiths' Association at Chicago, September 23 to 25, 1930, inclusive.

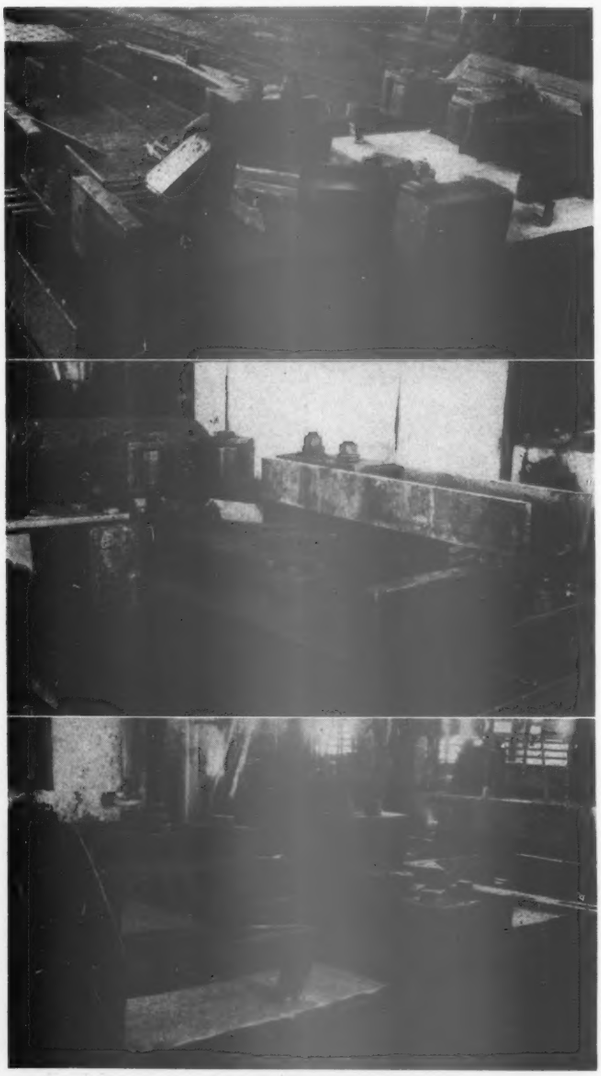


Fig. 1—Three views of the coupler-yoke operation—Top the machine dies open—Bottom views; two bending operations

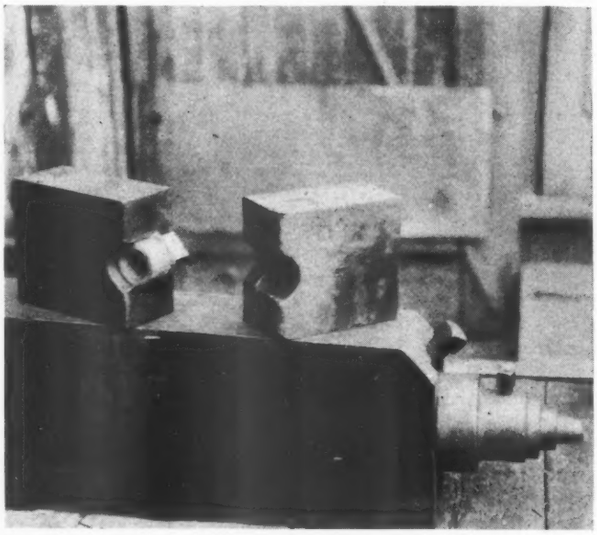


Fig. 2—Dies for making rod grease-cup caps

Fig. 2 shows a grease-cup-plug die used on main-rod grease-cup caps forged in one operation on a 3½-in.

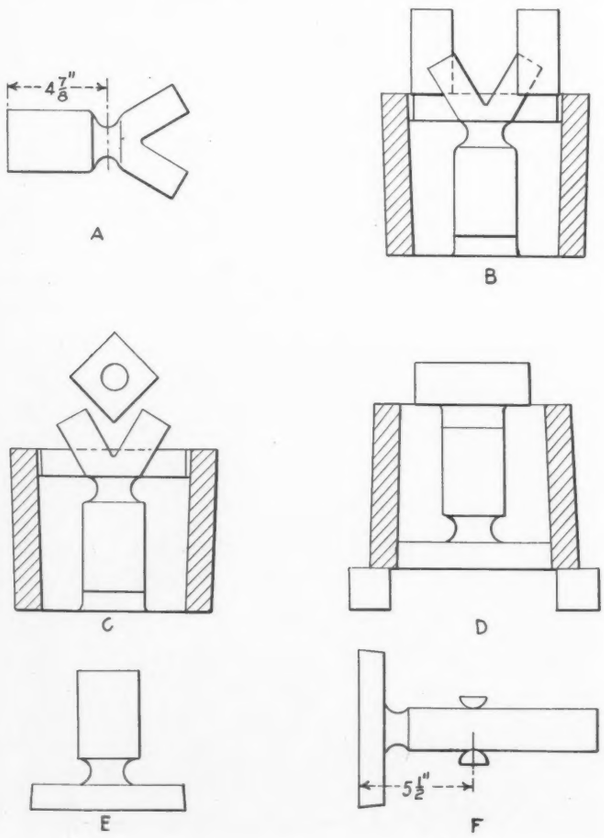


Fig. 3—Six operations in forming a throat sheet stay on a steam hammer using the dies shown in Fig. 4

forging machine. The material is 1¼ in. square and is fed through the sheer plate. The head tool upsets and forms the cap, and the finished forging is sheared off.

The general design of the dies for making throat stays under a steam hammer is shown in Fig. 4.

Fig. 3*A* represents the first operation. The material used is 3 in. square and 8¾ in. long. A distance of

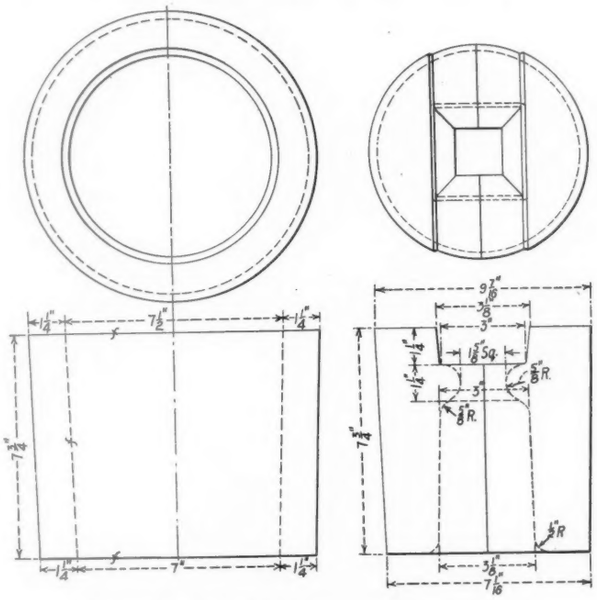


Fig. 4—Dies for making throat sheet stays on a steam hammer

4⅞ in. is measured to the center of a pair spring fullers checking it down to 1½-in. square, the other end measuring 3⅞-in. which is split as shown in Fig. 3*A*.

Fig. 3*B* represents the second heat with the forging having been driven down into position in the die ready, as shown in Fig. 3*C*, to spread open the split, and with a few sharp heavy blows the foot is reduced to proper thickness until the recess in the die is filled.

Fig. 3*D* shows the die turned upside down and, with a suitable block on top and under the edges of the band, the whole forging and two inside sections will fall out readily.

Fig. 3*E* shows the forging with the foot formed now

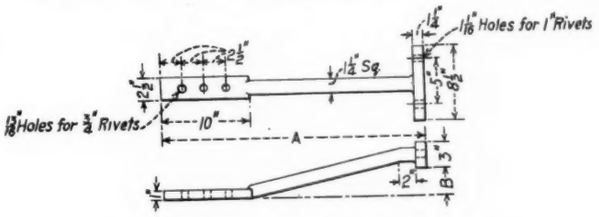
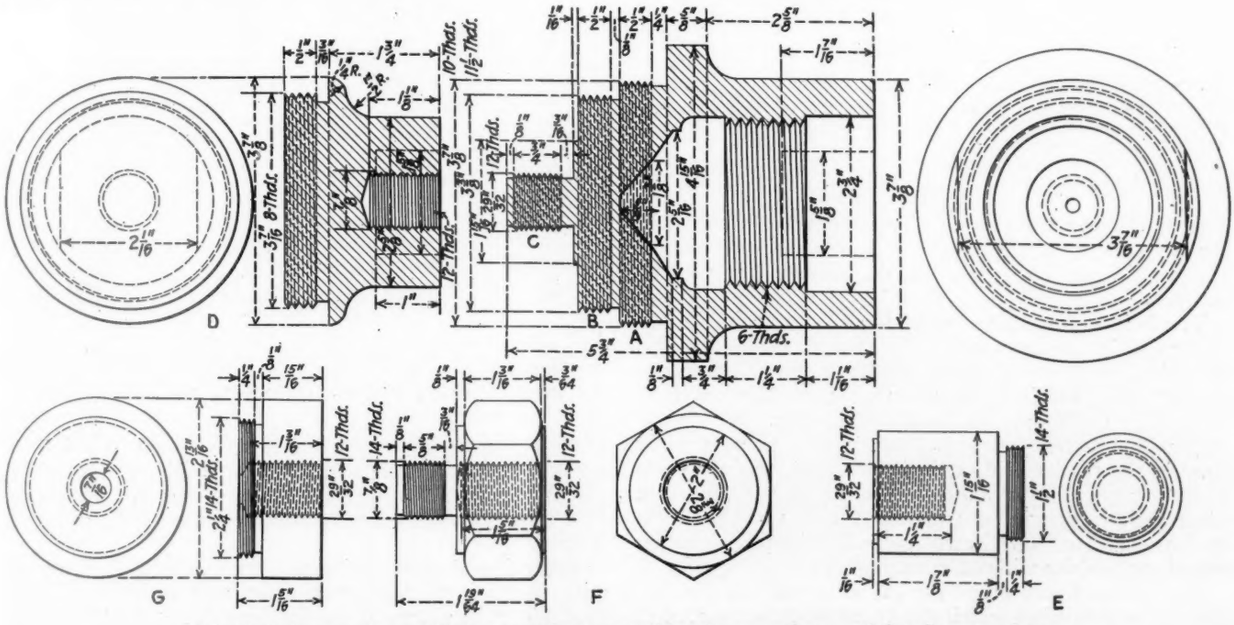


Fig. 5—The completed throat sheet stay

ready to be drawn out to 2-in. square, fullered and reduced to 1¼-in. square between the fullered part and the foot. The end is then drawn out to 2½ in. by ¾ in., and a die is used to form a fillet between the two sizes. The completed forging is shown in Fig. 5.

Machining Pop and Inspirator Valves

SHOWN in the drawing is a mandrel and fixtures for machining standard Consolidated safety valves and inspirator valves on a lathe. The mandrel is screwed on the lathe head in the usual manner. Fixture *A* is used for the 3½-in. new-style base, and fixture *B*, for the 3-in. new-style base of the Consolidated pop valve. Fixture *C*, is used in combination with fixtures *A* and *B* for machining feathers used in the 3½-in. new-style Consolidated pop valve. Fixtures *F* and *G* are used for machining the feathers removed from 3-in. new- and old-style Consolidated pop safety valves, respectively. These fixtures are screwed on fixture *C*. Fixture *E* is also applied to fixture *C* for machining No. 10, No. 11 and G type inspirator valves.

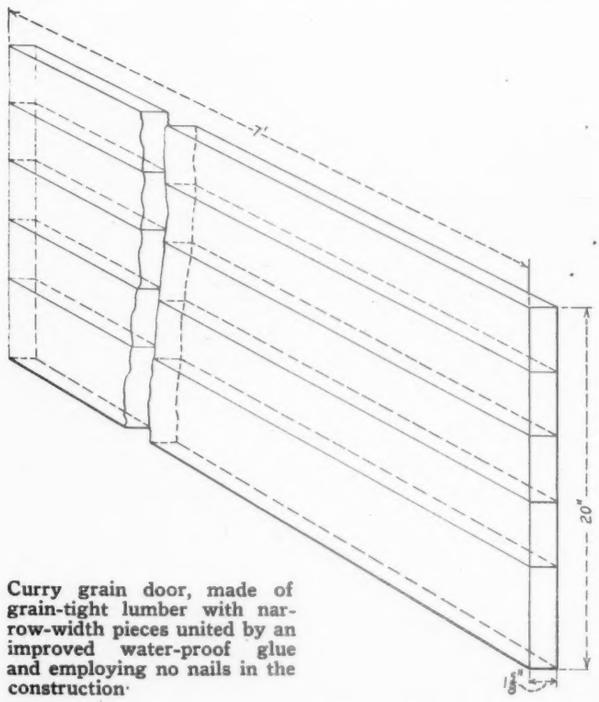


Mandrel for use in machining standard consolidated pop valves and inspirator valves

NEW DEVICES

Curry Grain Door

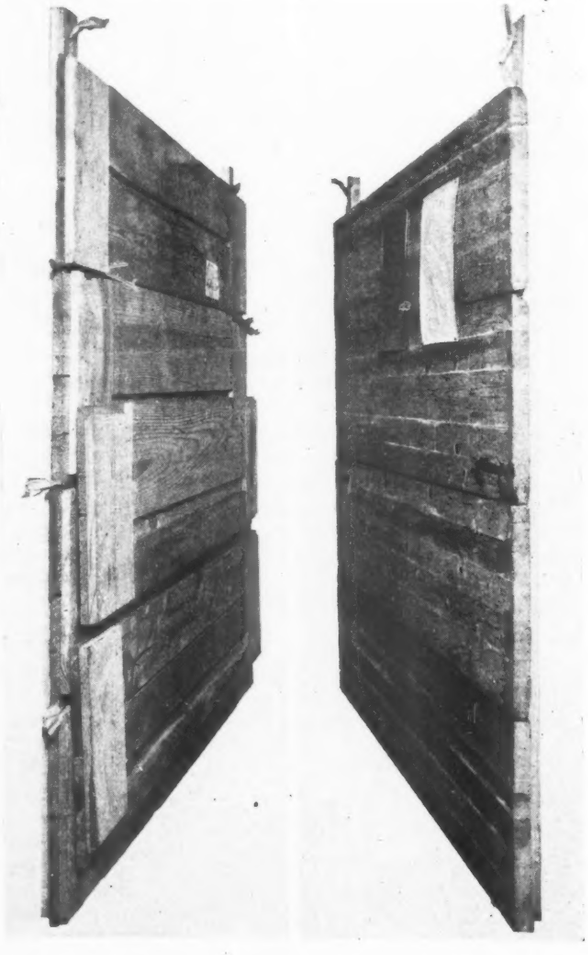
AN improved, removable grain door, designed to be leak-proof and strong enough without reinforcement to effect some important economies in connection with the coopering of box cars used for the transportation of grain, patents on which have been applied for, is being introduced by Curry & Co., 407 S. Dearborn street, Chicago. Like the General Managers' standard grain door, the Curry door is 20 in. wide, 7 ft. long and weighs about 60 lb. It is manufactured of narrow width, good quality, grain-tight lumber, 1⅝-in. thick, dressed on all sides, and having the edges glued together with an improved water-proof glue which strengthens and stiffens the door to such an extent that "doubling" the bottom courses is unnecessary. The door ends are then treated with a somewhat thinner solution of the same glue, tending to seal them against moisture and minimizing the tendency of the corners to split off when the doors are pried from the door posts, or subsequently roughly handled.



Curry grain door, made of grain-tight lumber with narrow-width pieces united by an improved water-proof glue and employing no nails in the construction

The built-up construction of the Curry grain door is illustrated in the drawing. The dressed edges are said to make possible grain-tight joints between the doors without any special precautionary measures such as "doubling" the doors and lapping the joints. In accordance with the usual practice, the doors are secured in place in the car by being nailed lightly to the door posts with four tenpenny nails driven in at an angle so that when each door is in turn pried up with a bar the nails bend over and are withdrawn from the door posts readily, releasing the door without damage to it.

Only seven Curry doors per car are required, three in the doorway through which the grain spout is inserted in loading the car, and four in the opposite doorway. The General Managers' standard grain door, on the other hand, made of two thicknesses of one-inch, low-grade lumber, selected for grain-tightness rather than for strength, necessitates the "doubling" of the two lower doors on each side of the car and requires a total of 11 doors. Sometimes, cars may be undercoopered with single thicknesses of standard grain doors, resulting in damage claims. More often, cars are overcoopered, as many as 13 doors being used per car. On the average, extensive surveys are said to have shown that for the loading of the heavier grains, constituting about 90 per cent of the grain movement, it is common practice to use 11 standard grain doors, four of which are applied to give additional strength at the bottom courses. This may be compared with 7 doors required when the Curry type is used.



Freight-car doorway coopered with six G. M. standard doors (left) and four Curry doors (right)—calking paper is used only to a limited extent with the Curry doors

Typical examples of freight car doorways, coopered with the General Managers' door and with the Curry grain door are shown at the left and at the right, respectively, in one of the illustrations. It will be observed

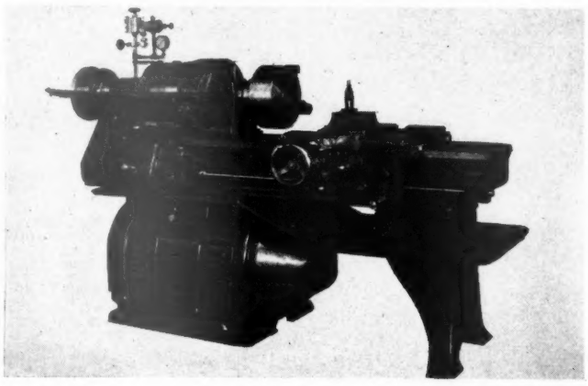
that caulking paper is applied at all joints with the standard door, whereas it is recommended for application with the Curry door only where the floor board, side posts or grain doors have become slightly warped or otherwise damaged.

While the initial cost of the individual Curry door is somewhat greater than that of the present standard door, the fact that four less doors are required makes the aggregate cost of coopering the car practically the same with either type of door. No excessive premium is therefore paid for the more effective service, increased life and much better appearance claimed as advantages of the new doors. In addition, it is maintained that the reduction in the number of doors required per car reduces by over one-third the grain doors which must be handled and hauled over the road annually as "company material"; effects a saving of 240 lb. of tare weight, or non-revenue freight, per car loaded; saves labor and time in coopering; expedites car handling at stations and thus helps in the attainment of more car-miles per day.

Curry grain doors may be stenciled with the names of originating carriers, and agents and shippers charged with them in accordance with the practice of some roads in an effort to secure the return of the doors, or an accounting for them. In case the doors are lost through off-line shipments, or otherwise, however, it is expected that eventually about as many doors will be received back from foreign connections as are lost, and, in the meantime, the actual money loss per car set of unrecovered doors will be no greater than at present since only seven Curry doors will get away as compared to eleven of the present standard door.

Monarch High-Speed Lathe

A *HIGH*-speed lathe which operates at 3,000 r.p.m. and which is designated as the Model AA machine, has recently been developed by The Monarch Machine Tool Company, Sidney, Ohio. The special features of this unit are: Timken bearings throughout, automatic length feed stops, any type of tool equipment desired, including automatic facing attachment, multiple tool rests, etc.



The Monarch model AA lathe which operates at spindle speeds of 3,000 r.p.m.

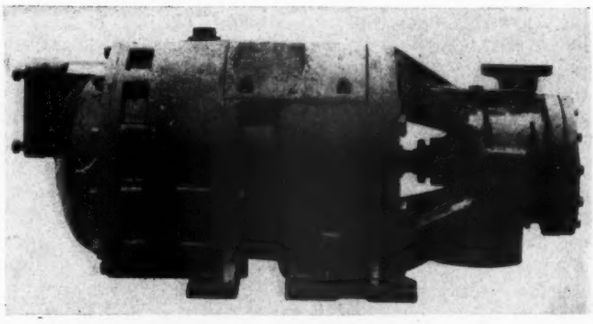
The machine, a 16-in. by 6-ft. lathe, operates at spindle speeds of 3,000 r.p.m. and higher and is intended to machine such pieces as can be handled most economically at high rates of speed with tungsten-carbide tools. Either a DC variable-speed motor or an AC multi-speed motor can be mounted in the cabinet base which is provided with louvres for ventilation. The drive is direct to the spindle by multiple V-belts running up between the walls of the bed, which are far enough apart to clear the V-belts without the use of idler pulleys. The drive from the spindle to the quick-change feed box is made by either a silent chain or multiple V-belts.

The bed of the lathe is made of carbon eutectic steel, so-called because it contains only 2.60 per cent to 2.70 per cent carbon. The bed machines to a steel-like bearing surface and has a tensile strength of from 55,000 to 60,000 lb. per sq. in.

B-A Locomotive Boiler Feed Pump

IN the illustration is shown the B-A locomotive boiler feed pump which has recently been developed by the Bird-Archer Company, New York, to handle water at the boiling point in connection with its locomotive water conditioner. This centrifugal pump unit consists of a steam turbine, pump and regulating device assembled in a compact enclosed unit. There are no additional control valves, over-speed trips, or any other parts required in the operation of the pump, regulation being by means of an ordinary globe valve in the cab. The water end of the unit is a two-stage, double suction pump. It is assembled from the end and may be completely taken apart and put together on the locomotive without disturbing any pipe or hose connections on the pump.

The steam turbine has a large diameter steel shaft and the turbine wheel is a one-piece steel forging. The castings are heavy to insure accurate alignment of the bearings which are adapted to the high speed at which the turbine is operated. The turbine wheel was designed to withstand speeds of 30,000 r. p. m. although the maximum operating speed is limited to 6,000 r. p. m.



The Bird-Archer boiler feed pump which is used in conjunction with the B-A locomotive water conditioner

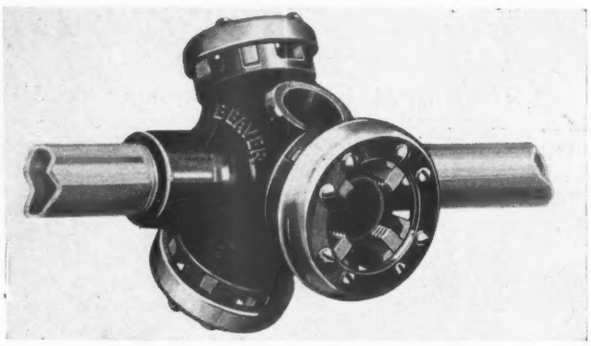
Over-speed protection is provided by a fly-ball governor designed along the lines of a standard governor which has been used in a large number of turbines in locomotive service. The governor mechanism and bearings run in a constant bath of oil. Lubrication of the bearings and governor mechanism is accomplished by an arrangement of the governor shaft which is hollow and has screw shaped flutes on the inside walls which lift the oil from a reservoir provided in the center casting. This arrangement furnishes a continuous spray over all moving parts requiring lubrication. The oil supply is replenished at one point for the entire unit. The design of the turbine and pump is such that condensation from the steam end and water from the pump end cannot enter the oil chamber.

The pump has a capacity of 9,000 gal. per hr. and is suitable for all but high pressure, special installations. The locomotive water conditioner of which the B-A boiler feed pump is a part, is a new type of feedwater heater located on the tender and offering the advantages of hot-water storage, oxygen removal and water treatment in addition to its heating function. It was fully described in the March, 1930, issue of the *Railway Mechanical Engineer*.

Beaver Three-Way Die Stocks

THE Borden Company, Warren, Ohio, recently added to its list of products a line of three-way die stocks, the dies and caps of which are interchangeable with the No. 3 Beaver ratchet die stocks. The die segments of the three-way die stocks are square in shape and are electrically heat treated. The dies are driven by the solid body of the tool and not by a cap held on the body by screws. It is designed with large openings in the body to provide for accessibility for oiling and chip clearance. The die retaining ring is of pressed steel to insure strength, a pinch of 1-32 in. being used to hold the dies in position. Extra-heavy and extra-long handle bosses are provided so that the handles will not work loose.

The tools are furnished in two sizes and are designated as the No. 33 Beaver and No. 34 Beaver three-way die stocks. The former of these has a threading range of ⅜ in., ½ in. and ¾ in. and weights 6½ lb., while the latter has a threading range of ½ in., ¾ in. and 1 in. and weighs 9 lb.



The 33 Beaver 3-way die stocks

Atomic-Hydrogen Welding Machine

AN automatic welder for atomic-hydrogen welding, the first application of automatic equipment to this welding process, has recently been placed on the market by the General Electric Company, Schenectady, N. Y. The welder is designed for longitudinal seam welding of all kinds. It consists of a clamping mechanism for holding the work, an automatic travel carriage, a welding head and the usual control devices, and other accessories. The clamping mechanism and travel carriage are of standard types, while the welding head, control, etc., are of special design to suit the use of atomic-hydrogen welding. In addition there is an auxiliary feeding device for feeding filler rod into the arc, as the tungsten electrodes used to form the arc are consumed slowly and do not contribute metal to the weld.

In operation the work is clamped in place in the usual manner, the travel carriage is set at one end of the seam and the start push-button is depressed. The remainder of the operation is automatic. With the pressing of the start button, the line contactor closes, applying power to the equipment and simultaneously opening a valve supplying hydrogen to the arc. The striking of the arc, movement of the travel carriage and length of the arc are all controlled automatically.

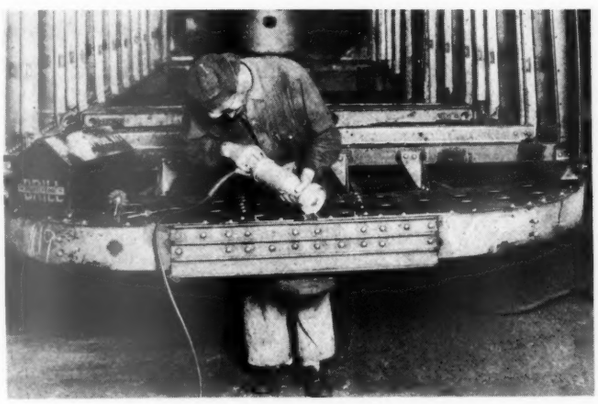
The atomic-hydrogen welding process is one by means of which hitherto unweldable metals can be melted and fused without trace of oxidation. Welding can also be performed in some cases on metals as thin as a sheet of ordinary writing paper. The method util-

The General Electric automatic welding machine for use with the atomic-hydrogen welding process

izes the passage of a stream of hydrogen through the arc between two electrodes. The heat of the arc breaks up the hydrogen molecules into atoms and these combine again a short distance beyond the arc into molecules of the gas. In so doing they liberate an enormous amount of heat to produce an effective welding temperature. In addition, since atomic hydrogen is a powerful reducing agent, it reduces any oxides which might otherwise form on the surface of the metal. Alloys containing chromium, aluminum, silicon or manganese can thus be welded without fluxes and without surface oxidation.

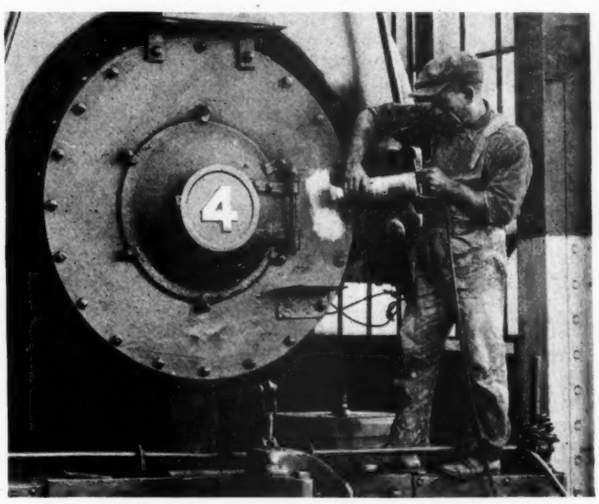
The Brill Multi-Tool

A PORTABLE electric hand tool with which 15 major operations and a number of minor functions can be accomplished and which is designated as the Brill Multi-Tool, is a product which has recently been placed on the market by the J. G. Brill Company, Philadelphia, Pa. The tool weighs 5¼ lb. and is operated by a four-bearing power unit. It was developed to obtain a portable hand tool with one power unit that could be adequately used for the completion of a number of different jobs. Various attachments can be screwed onto the the nose of the tool. These various attachments are used for drilling, grinding, buffing, sanding, sawing, nut setting, screw driving, planing, filing, valve grinding, reaming, under cutting, nibbling, shearing and mixing.



The multi-tool being used with a grinding attachment

In railroad shops it is particularly adapted to cleaning the front ends of locomotives, the outside of smoke boxes for repainting, and for polishing side rods and valve-motion levers. The tool was also developed for use in rail-car repair shops where it is useful for cleaning carbon, grinding valves, polishing, grinding, etc.



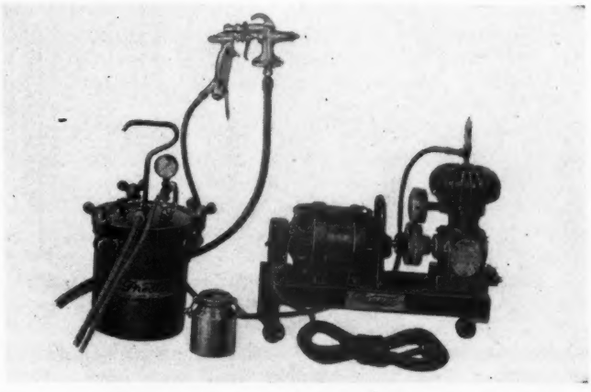
The multi-tool with a wire-brushing attachment in use on the front end of a locomotive

Presto 2½-Gal. Spray Painting Equipment

THE Metal Specialties Manufacturing Company, 338-352 North Kedzie avenue, Chicago, has recently added the Model 150 spray painting equipment to its line. The outfit is electrically powered and is equipped with a 2½-gal. pressure-feed material tank which holds sufficient material to spray from 800 to 1,000 sq. ft. One of the patented features of the spray gun is an air conditioning unit built into the hollow part of the handle.

The gun is of the pressure-feed type with internal atomization in the spray head which is designed to assure a steady, uniform spray of light or heavy materials the instant the trigger is pressed. The ring-valve piston-type compressor which is used to operate the device is directly connected to the electric motor. A patented expansion air tank built into the compressor head eliminates all pulsation and bulky storage equipment.

The intake valve on the compressor is fitted with an



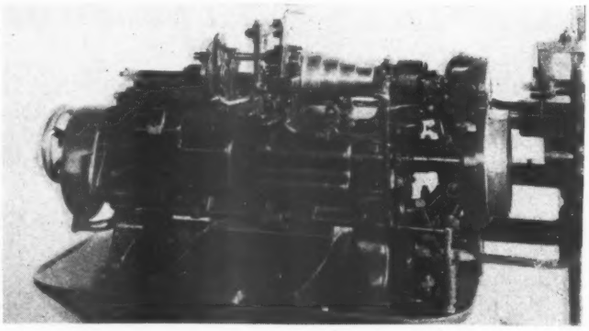
The Presto 2½-gal spray-painting outfit

air filter which traps dust and foreign matter. This feature, in addition to the second air conditioning unit in the handle of the gun, permits only clean, dry air to pass through the spray head. Each outfit is regularly equipped with three outer spray heads for fan, round or angle spraying.

B. & S. Roller Feed Attachment

THE Brown & Sharpe Manufacturing Company, Providence, R. I., recently brought out a roller-feed and timing mechanism which is designed for use on Brown & Sharpe automatic screw machines. It is to be used on jobs where the pieces to be machined are of considerable length, one operation of the roller feed being sufficient to feed the piece the required distance, eliminating the multiple feedings with feeding fingers. The end of each new bar is positioned at a point to permit trimming to remove the waste, leaving only a suitable amount for chucking at the last end.

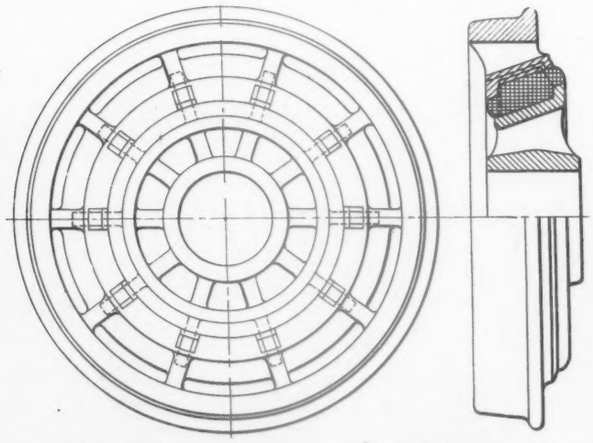
To determine the position for trimming, a swing stop with control mechanism is used. This stop functions only once to each new bar and is controlled by a ratchet wheel operated by a pawl which is moved by the rear cross slide each time a piece of work is cut off. The ratchet wheel has a number of teeth which is a multiple of the number of pieces available in each 10-ft. bar. As an example, take a ratchet which has 44 teeth. If 11 pieces are contained in each bar, 4 operating dogs will be necessary to cut the required number of pieces. These dogs are mounted on the side of the ratchet wheel and when brought to position allow the swing-stop mechanism to function. When this trimming operation is completed, the bar is again fed to the stock stop which determines the correct length of each piece available in the bar.



The roller feed and timing mechanism used in conjunction with B. & S. automatic screw machines

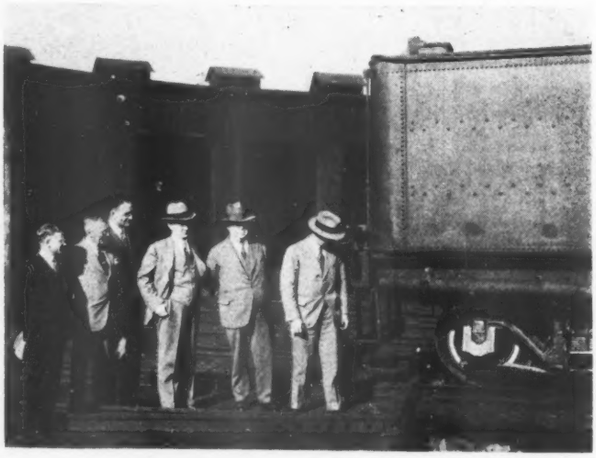
A Rubber Cushioned Car Wheel

SINCE April 1930 the Goodyear Tire & Rubber Company, Akron, O., has had on test a rubber-cushioned wheel for locomotive tender trucks, passenger and freight cars. The test wheels are in operation on a locomotive tender truck on the Akron, Canton & Youngstown. One of the accompanying illustrations shows the sectional design of the wheel and another its application on a tender truck.



Sectional view of the rubber-cushioned tender-truck wheel showing the rubber pad

The wheel consists of two sections which might be termed the hub and the rim section of the wheel between which is a specially designed cushion of solid rubber. The claims made for the new type wheel are greater comfort to passengers and train crews and a saving in wear and tear on rolling stock and roadbed. The shocks that the ordinary car wheel is subjected to when it hits switches, joints and frogs are said to be eliminated by the use of this wheel and the absence of shock thereby contributes to longer life to bearings, axles and trucks.



The Goodyear rubber cushioned wheel applied to a tender truck

It is also claimed that, due to the design of the rubber cushioning, the side-sway of cars is effectually "dampened".

The Goodyear cushion wheel is made much like the ordinary car wheel of the all-steel type except that a cushion of uncured rubber is built between the hub and the rim. After this operation the wheel with the rubber is put into a vulcanizer and cured much as a solid rubber truck tire is vulcanized firmly to a metal rim. A pocket inside the wheel holds the rubber pad, which is about 2½ in. thick, 6 in. wide and tapers beadlike to a thickness of about 1¼ in. This beadlike projection is the only portion of the flexible pad that is visible on the surface of the wheel.

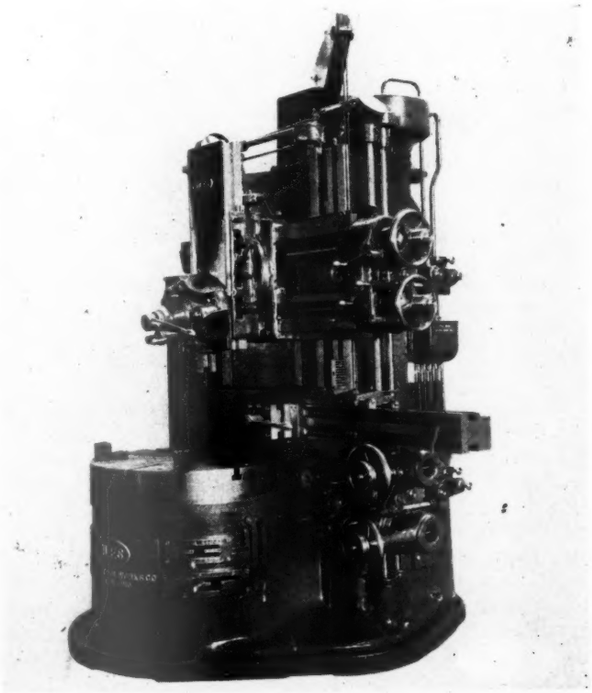
The heat that is generated in the wheel when the brakes are applied is said not to affect this type of wheel because of the ventilation provided in the wheel by large holes in the disc-like portion giving the effect of a set of spokes between the steel tire and the rim. When the steel tire is worn out it can be removed, the rubber cushion detached and the old hub used again in the construction of another complete wheel.

The tests made so far on the A. C. & Y. seem to indicate the feasibility of the invention and the possibility of adapting it to larger wheels and flexible couplings for shafting.

The rubber cushioned wheel is the invention of E. F. Maas of the Goodyear engineering staff.

Niles Side-Head Boring Mill

THE Niles Tool Works Company, Hamilton, Ohio, has brought out a 42-in. to 50-in. side-head boring mill with a one-piece base and column which is machined on a special tool to insure accurate construction. The ways for the crossrail and the side head are planed and scraped, these surfaces then being used for locating the casting on the special boring machine where the spindle hole, the taper thrust track, and the boring for the main drive shaft are finished. This is to insure the spindle being parallel to the ways and the main drive a true right angle to the spindle.



Niles 42-in. to 50-in. side-head boring mill with a one-piece base and column

The crossrail has a three-track bearing surface with a narrow guide for the vertical-head saddle, the screw for the longitudinal motion being placed between the two lower tracks. The vertical head slides in bearings of the square-lock type with taper gib adjustments in all directions so that wear can be taken up and alinement maintained between the turret and the table spindle.

The side head is an independent unit and is attached directly to the column. There are but two movable joints between the cutting tool and the column; one for vertical travel and the other for horizontal travel. The casting extends across the column and is equipped with three bearings. One of these is a main bearing with a long and narrow guide on the right-hand side of the column, while the other two are flat bearings, one in the center of the column and the other on the left side of the column.

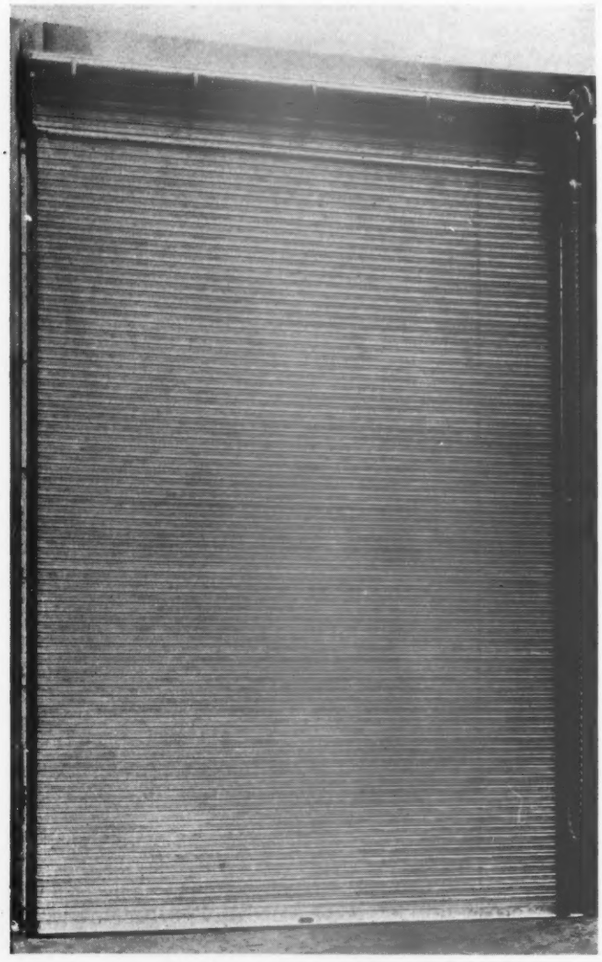
Both heads each have independent rapid traverse which may be engaged in one direction only, operating at a speed of 120 in. per min. irrespective of feeds or table speeds. Sixteen feeds, ranging from .004 in. to .750 in. per revolution of the table, are provided in the feed mechanism for both the rail head and the side head. Both heads are fitted with large micrometer dials, as well as graduated scales and observation stops for the rail and the side head. Feed units are controlled by pull pins with safety interlocks and are of the selective sliding-gear type with gears of heat-treated alloy steel. The table speed-change gear box is assembled as a separate unit in the bed and provides 12 speed changes of the selective sliding-gear type, ranging from 3.2 r.p.m. to 70 r.p.m.

The spindle is of semi-steel, ground and lapped to provide a running fit in bearings which have removable bronze bushings both top and bottom. The table is driven by spiral bevel gears, the driving gear of which is of forged steel. The pinion gear is supported in roller bearings at either end to absorb the thrust incident to spiral gears. Motion to the table is engaged by a multiple disc clutch in which is incorporated a cone brake for stopping the table when the clutch is released.

To protect all mechanisms against damage due to faulty manipulation or coming in contact with obstructions, the table speed changes are interlocked with the clutch lever, feeds cannot be engaged with the rapid traverse in motion or vice-versa, and feed gears interlock, making it impossible to engage conflicting ratios at the same time. Also, large frictions in the feed and traverse mechanisms protect these parts while additional safety features protect crossrail elevation. All bearings of the boring mill are bronze bushed, all gears are of heat-treated steel, and the entire machine is lubricated by an automatic oiling system.

Aluminum Alloy Used in Enginehouse Doors

WITH the idea of securing greater speed of operation and increased life in enginehouse doors, the Norfolk & Western recently installed 21 vertical rolling, or curtain-type, doors, constructed of light, strong aluminum alloy, in the older of its two enginehouses at Williamson, W. Va. These doors, which were furnished by J. G. Wilson Corporation, Norfolk, Va., are 13 ft. wide by 19 ft. 11 in. high and weigh 323 lb. each. The slats of the new doors are made from 19-gage aluminum alloy sheet and the bottom bar in each case is an angle section of the same material produced by the extrusion process. Fabrication throughout is with aluminum rivets.



One of the Wilson aluminum-alloy enginehouse doors recently installed on the N. & W.

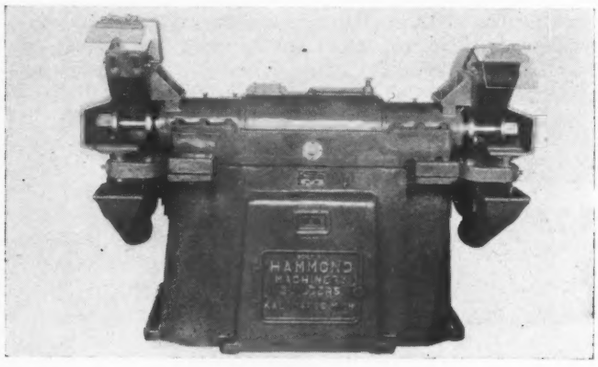
Operation of the doors is by means of chain hoist mechanisms, in each case consisting essentially of a train of spur gears, having a ratio of 6.8 to 1. It is said that the new type doors weigh less than one-third the weight of doors of similar type constructed of galvanized steel sheet and can be raised and lowered about three times as fast because of the smaller gear ratio possible in the operating mechanisms.

In addition to the lightness of the new doors and the increased speed with which they can be operated, it is expected that the doors will give unusually long life because of the high resistance of the aluminum alloy of which they are constructed to the corrosive action of sulphur fumes and other gases prevalent about enginehouses. In view of this quality of the aluminum alloy used, the doors are not painted, which cuts one item of usual maintenance work.

Select-O-Speed Grinder

THE Hammond Machinery Builders, Kalamazoo, Mich., has developed a grinder, designated as the Select-O-Speed, in the design of which is included a combination herring bone gear and multi-V belt drive. This drive is designed to provide a high operating efficiency for snagging and rough grinding work, to improve the accessibility of parts and to insure vibrationless operation.

The grinder operates at an approximate peripheral speed of 9,000 surface ft. per min., a speed which is estimated to provide the maximum grinding efficiency on bakelite and rubber-bonded wheels. It can also be arranged for use with vitrified grinding wheels. Wheels of 24 in., 20 in., 18 in. and 16 in. diameter can be used with the machine, which is designed so that it can be operated with a 7½-hp., a 10-hp. or a 15-hp. motor.



The Hammond Select-O-Speed grinder which has a combined multi-V belt and herring-bone gear drive

Power is transmitted from a motor, mounted at the rear of the base, to an intermediate drive shaft by means of a Multi-V belt. Speeds are changed by means of quick-change pulleys on the motor which carry protective features so that the faster speeds used with the small wheels cannot be operated on the large wheels. The power from the intermediate spindle to the main spindle is transmitted by means of herringbone gears operating in a bath of oil, six oversize ball bearings being used in which to mount the spindle.

The wheel guards used with the machine are made of boiler-plate steel and built in accordance with the American Standards Association recommendations. They are adjustable to compensate for the wear of the wheel and are fitted with shatterless-glass eye shields. The spindles are made of chrome-nickel steel, ground and accurately balanced. The motor is protected from overload, low voltage and phase failure by means of a Cutler-Hammer automatic motor starter. Convenient oilers with oil level gages and flushing plugs are also furnished.

Sand-Blast Helmet with Forced Ventilation

THE Panghorn Corporation, Hagerstown, Md., has developed an all-rubber sand-blast helmet which is designated as the Pangborn Type DE helmet. It is designed to protect the wearer's eyes, flesh and lungs. A curved window, protected by a bulged screen, gives true

The Pangborn DE sand-blast helmet and type B air washer for supplying the helmet with water-washed air

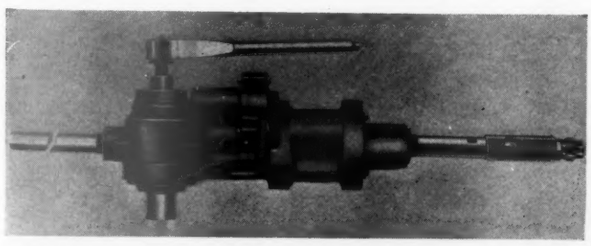
vision. The window glass and the screen are so attached to the helmet that they are both replaceable.

Fresh air is kept circulating inside the helmet at any desired pressure. Also, a fixed jet sprays a stream of air onto a soft sweat band to cool the operator's head while another jet is used to spray air onto the outside of the visor to keep dust from fogging the visor window.

Another feature applicable to this helmet is the Pangborn Type B air washer which supplies the operator with clean water-washed air practically at atmospheric pressure.

Hercules Heavy-Duty Motors

IN the illustration is shown a heavy-duty drilling and reaming motor designed for use on structural-steel work, in railroad shops and in plants building heavy



The Hercules No. 267 heavy-duty reaming and drilling tool

equipment such as engines and machine tools. In addition to being a drilling and reaming motor, it can also be used for setting nuts and driving staybolts. The motor, of which there are two sizes designated as the Hercules No. 257 and No. 267, is the product of the Buckeye Portable Tool Company of Dayton, Ohio.

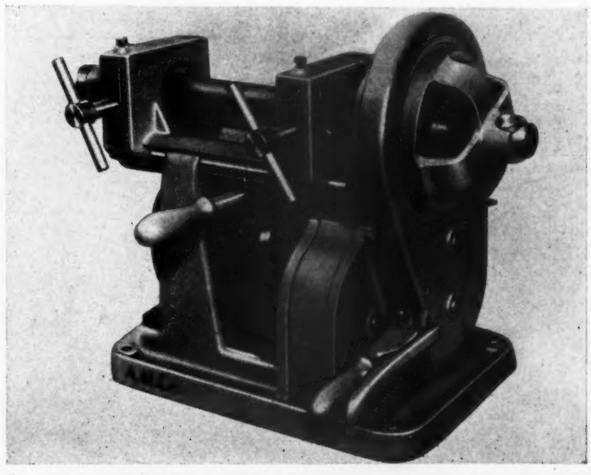
The motor is 4⅜ in. wide, 6 in. high, and 15 in. long. The spindle, which has a No. 4 Morse taper socket, is located at one end of the tool to facilitate close corner work. The diameter of the spindle end is 3⅞ in. and the distance from the end of the No. 4 Morse taper socket to the end of the screw feed is 9 in. The feed screw has a travel of 2¼ in. and is operated by a reversible ratchet wrench.

The tool is driven by a Hercules rotary compressed-air motor. It is compounded down to a spindle speed of 140 r. p. m. in the No. 257 machine and to 190 r. p. m. in the No. 267 machine. The gears are of heat-treated alloy steel and are mounted on gear spindles set in heavy-duty ball bearings. The bearings and rotating parts are grease lubricated through fittings mounted on the casing. The casing is doweled and bolted together in such a manner as to keep all parts in alinement. When dissembling for repairs, the removal of only four nuts is required to open up the entire motor unit.

The tool has a capacity for a 1 5-16-in. bridge reamer, a 2-in. drill in steel, and a 1¼-in. U. S. standard nut driver. If desired the tool can be equipped with a double-end squared spindle for both right- and left-hand rotation, thus making the tool adaptable for either running on or removing nuts and for tapping. When in use the tool can be hung by a counter-balance in either a horizontal or a vertical position by means of a screw eye.

Axelson Pipe Threader

A PIPE threading machine, designed for a wide range of uses, has been developed by the Axelson Manufacturing Company, Ltd., Los Angeles, Cal. The pipe to be threaded is gripped by two-jaw chucks which are partly automatic in action and which remain stationary while a standard square die is revolved, cutting the thread. The threader will cut at the rate of 17 r.p.m. on all sizes from ½-in. to 2-in. pipe, the required time for completing eleven threads being about 40 sec. After the thread is completed, the dies are reversed and during this operation rotate at 34 r.p.m. In addition, thread cutting attachments are available for the cutter head to permit cutting-off, reaming and bolt making.



The Axelson pipe threader and cutter

Among the Clubs and Associations

NEW YORK RAILROAD CLUB.—The fifty-eighth annual dinner of the New York Railroad Club will be held in the grand ballroom of the Hotel Commodore, New York, Wednesday, December 17, at 7 p.m. The speaker of the evening will be Judge Harold B. Wells of the Court of Errors and Appeals, State of New Jersey. George Le Boutillier, newly elected president of the club, will preside.

EASTERN CAR FOREMEN'S ASSOCIATION.—The Modern Method of Car Cleaning will be discussed by T. G. Case, general car foreman, Grand Central Terminal, New York, before the meeting of the Eastern Car Foremen's Association which will be held on December 26 at 8 p.m. at 29 West Thirty-Ninth street, New York.

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—At 2 p.m. on December 11 at the office of the Chicago, Burlington & Quincy at Omaha, Neb., M. P. Schmidt, general car foreman of the Chicago, Milwaukee, St. Paul & Pacific will address the members of the Car Foremen's Association of Omaha, Council Bluffs and South Omaha Interchange on the work of the association and the progress made since its organization in 1912.

PACIFIC RAILWAY CLUB.—The associate members of the Pacific Railway Club are arranging a program for the one hundred and sixty-fourth meeting of the club which will be held in the rooms of the Transportation Club in the Palace Hotel, San Francisco, Cal., on December 11. This meeting, which has become an annual feature of the club, will be given over entirely to entertainment which will be followed by a repast at which the entire membership will be the associates' guests.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—The next meeting of the Southern and Southwestern Railway Club will be held on January 15, 1931, at 10 a.m. at the Ansley Hotel, Atlanta, Ga. Roller bearings will be discussed by a representative of Fafnir Bearings, Inc., and feedwater heaters by a representative of the J. S. Coffin, Jr., Company. A. E. Clift, president of the Central of Georgia, who was originally scheduled to speak at the November meeting, will talk on "Things the Public Should Know about the Transportation Industry."

CENTRAL RAILWAY CLUB OF BUFFALO.—A debate: "Resolved that Departmental Organization on Railroads is Superior to Divisional Organization," is to be the feature of the meeting. The affirmative side of the question will be taken by Louis A. Hillman, captain, Delaware, Lackawanna & Western; James J. Lewis, D., L. & W.; Clark E. Brown, D., L. & W.; A. H. Schindelbeck, alternate, D., L. & W. The negative side will be taken by E. S. Duffy, Jr., captain, Wabash; P. E. Bradley, Pere Marquette; A. E. Hermann, Nickel Plate; and W. J. Benner, alternate, Canadian National. The meeting will convene at Hotel Statler, Buffalo, New York at 8 p. m., on December 11. ¶The election of officers for 1931 will take place at this meeting. The annual dinner of the club will be held Thursday evening, January 8, 1931, the officers for 1931 being installed at the regular meeting at 2 p. m.

Club Papers

Air-Brake Maintenance

Manhattan Air Brake Club.—Meeting held November 21 in Room 2300, 150 Broadway, New York. ¶The members of the Manhattan Air Brake Club discussed the following subjects at its November meeting: Brake-pipe hose; Adjustment of release times on UC, LN, PM, and PC equipments; Train control; Centrifugal dirt collectors; Locomotive piping; Triple valve repair practice; Handling 150-car or longer freight trains, and Brake-valve repair practice. ¶In the discussion of the brake pipe hose, the question was brought up as to the number of hose burst and damaged due to improper clamping or defective hose coupling. The question also came up as to whether or not there should be a standard practice for clamping pipes on locomotives and standard location for all cut-off cocks. ¶The increasing length of freight trains have added many problems for the air-brake supervisor to solve. Long trains naturally create many complications in train handling, train preparation and design of air-brake equipment, especially with respect to main-reservoir volumes and feed-valve capacity. Special instructions for handling long trains are frequently necessary, and consideration given to the use of retaining valves, etc.

Air Transportation

Western Railway Club. — Meeting held at the Hotel Sherman, Chicago, Monday evening, November 24. Two papers presented as follows: "Design and Construction of Airships," by V. R. Jacobs, assistant manager, Aeronautics Department, The Goodyear Tire & Rubber Co., and "Operation of Airships," by Commander C. E. Rosendahl, U. S. N., formerly commander of the United States Dirigible Los Angeles and official representative of the United States on the world cruise of the Graf Zeppelin. ¶This meeting represented the second experiment of the Western Railway Club in getting away from railroad subjects, particularly those relating to mechanical-department operation. The success of the meeting, from the point of view of attendance, at least, cannot be questioned. Approximately 500 members and guests of the club were present, and, of these, about 10 per cent were ladies to whom a general invitation was also extended. Samuel O. Dunn, editor of the Railway Age, presided and introduced the speakers, also the guest of honor, Rear-Admiral W. S. Crosley, U. S. N., commandant of the U. S. Naval Training School at Great Lakes, Ill. ¶Both papers were accompanied by moving pictures which helped materially in visualizing the present status

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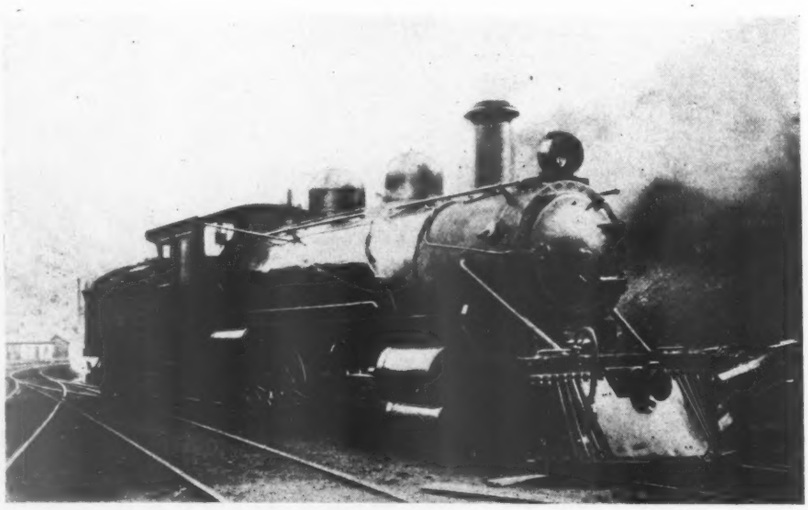


A Vauclain compound 2-8-0 type locomotive on the New Zealand Government Railways, built by the Baldwin Locomotive Works in 1896

of efforts to make lighter-than-air ships commercially feasible. Mr. Jacobs explained a few of the more important problems presented in the construction of these air craft which are generally divided into three types, namely, rigid, semi-rigid and non-rigid. ¶ Commander Rosendahl held the closest attention of the membership throughout his discussion of the operation of airships. He said that there are no present indications that the lighter-than-air ship will ever be a competitor of the railroads, owing to speed limitations, for one thing. Its principal field of usefulness will be in long distance, transoceanic flights, in which its speed of operation of 60 to 70 miles an hour is practically three times that of water vessels, thus giving it an important economic advantage. Heavier-than-air craft, with speeds of 100 and 200 miles an hour, or more, will, however, take a certain amount of high-class fast passenger, mail and express traffic which would otherwise travel by the railways as being the next fastest means of transportation.

Passenger-Car Heating

Chicago Car Formen's Association.—Meeting held at the Great Northern hotel, Chicago, Monday evening, November 10. Paper on the subject "Steam Heating of Long Passenger Trains," by W. J. McClennan, general shop inspector, New York Central, New York. ¶ Mr. McClennan presented a carefully-prepared paper which contained a wealth of information and detailed technical data relating to this subject. The influence of train length, type of car construction, including the proportion of window area, and many other factors in the satisfactory heating of long passenger trains were discussed at length. Mr. McClennan advocated the use of unrestricted two-inch metallic connections between cars, insulated as thoroughly as practicable, in order that high steam pressures can be delivered, if necessary, for heating 20-car trains under the most adverse temperature and wind conditions. Ten pounds pressure per car is usually sufficient for heating a passenger coach under average winter conditions, but, if this does not prove adequate, the trainmen signal for more pressure, and it is absolutely essential to provide steam-heat connections which will safely stand these high pressures. ¶ Mr. McClennan stressed the advisability of having all adjustments of the individual car regulators made at terminals by experienced men rather than en route by someone not thoroughly familiar with their operation and adjustment. ¶ One of the principal points emphasized in the discussion of Mr. McClennan's paper was the urgent necessity of a thorough inspection and overhauling of steam-heat equipment in advance of the severe winter weather if satisfactory service is expected. Many roads in northern climates are now reaping the benefits of this important preparatory work and others, no doubt, wish that they had been a little more thorough in correcting the conditions which subsequently cause steam-heat failures.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

AMERICAN RAILWAY ASSOCIATION.—DIVISION V.—MECHANICAL.—V. R. Hawthorne, 59 East Van Buren street, Chicago.
DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.
DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey street, New York.
DIVISION I. — SAFETY SECTION. — J. C. Caviston, 30 Vesey street, New York.
DIVISION VIII.—CAR SERVICE DIVISION.—C. A. Buch, Seventeenth and H streets, Washington, D. C.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.
RAILROAD DIVISION.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York.
MACHINE SHOP PRACTICE DIVISION. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.
MATERIALS HANDLING DIVISION.—M. W. Potts, Alvey- Ferguson Company, 1440 Broadway, New York.
OIL AND GAS POWER DIVISION.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.
FUELS DIVISION.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

ASSOCIATION OF RAILWAY SUPPLY MEN.—J. W. Fogg, MacLean-Fogg Lock Nut Company, 2649 N. Kildar avenue, Chicago. Meets with International Railway General Foremen's Association.

BOILER MAKER'S SUPPLY MEN'S ASSOCIATION.—Frank C. Hasse, Oxweld Railroad Service Company, 230 N. Michigan avenue, Chicago. Meets with Master Boiler Makers' Association.

CANADIAN RAILWAY CLUB.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT OFFICERS ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 3001 West Thirty-ninth Place, Chicago, Ill. Regular meeting, second Monday in each month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 608 South Main street, Los Angeles, Cal. Meetings second Monday of each month except July, August and September, in the Pacific Electric Club building, Los Angeles, Cal.

CAR FOREMAN'S ASSOCIATION OF OMAHA, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except July and August, at American Hotel Annex, St. Louis, Mo.

CENTRAL RAILWAY CLUB OF BUFFALO.—T. J. O'Donnell, 1004 Prudential building, Buffalo, N. Y. Regular meeting, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 453 East Sixth street, Cincinnati. Regular meeting second Tuesday, February, May, September and November.

CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler avenue, Cleveland, Ohio. Meeting first Monday each month, except July, August and September, at Hotel Hollenden, East Sixth and Superior avenue.

EASTERN CAR FOREMEN'S ASSOCIATION.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings fourth Friday of each month, except June, July, August and September.

INDIANAPOLIS INTERCHANGE CAR INSPECTION ASSOCIATION.—E. A. Jackson, Box 22, Mail Room, Union Station, Indianapolis, Ind. Regular meetings first monday of each month at Hotel Severin, Indianapolis, at 7 p.m.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S SUPPLY MEN'S ASSOCIATION.—J. H. Jones, Crucible Steel Company, of America, 650 Washington boulevard, Chicago.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash street, Winona, Minn.

INTERNATIONAL RAILWAY SUPPLY MEN'S ASSOCIATION.—W. J. Dickinson, acting secretary, 1703 Fisher building, Chicago. Meets with International Railway Fuel Association.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, 3730 South Prieur street, New Orleans, La. Meetings third Thursday in each month.

MASTER BOILERMAKER'S ASSOCIATION. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—See Car Department Officers Association.

NATIONAL SAFETY COUNCIL—STEAM RAILROAD SECTION: W. A. Booth, Canadian National, Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston.

NEW YORK RAILROAD CLUB.—Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York. Douglas I. McKay, executive secretary, 26 Cortlandt street, New York.

PACIFIC RAILWAY CLUB.—W. S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

PUEBLO CAR MEN'S ASSOCIATION.—I. F. Wharton, chief clerk, Interchange Bureau, Pueblo, Colo.

RAILWAY BUSINESS ASSOCIATION. — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

RAILWAY CAR MEN'S CLUB OF PEORIA AND PEKIN.—C. L. Roberts, chief clerk, Peoria & Pekin Union Railway, 217 Lydia avenue, Peoria, Ill.

RAILWAY CLUB OF GREENVILLE.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meetings third Tuesday of each month, except Juue, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular Meeting fourth Thursday in month, except June, July and August. Ft. Pitt Hotel, Pittsburgh, Pa.

RAILWAY EQUIPMENT MANUFACTURERS' ASSOCIATION.—F. W. Venton, Crane Company, 836 South Michigan avenue, Chicago. Meets with Traveling Engineers' Association.

RAILWAY FIRE PROTECTION ASSOCIATION.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md. Next meeting, October 21-23.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, June, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

SUPPLY MEN'S ASSOCIATION. — E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division, American Railway Association.

SUPPLY MEN'S ASSOCIATION.—Bradley S. Johnson, W. H. Miner, Inc., Chicago. Meets with Master Car Builders and Supervisors' Association.

TRAVELING ENGINEERS' ASSOCIATION. — W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio. Next convention March 25 to 28, 1931, Hotel Sherman, Chicago.

WESTERN RAILWAY CLUB.—W. J. Dickinson, 343 South Dearborn street, Chicago. Regular meetings, third Monday in each month, except June, July and August.

NEWS

W. W. BROWN, assistant mechanical engineer of the Boston & Maine at Billerica, Mass., has recently returned from Cuba where he spent two months advising on mechanical matters, standardization practices, materials, etc.

THE CHICAGO, MILWAUKEE, ST. PAUL & PACIFIC has let a contract for the construction of a building which will house a waste reclamation plant at Milwaukee, Wis., for the extraction of oil and grease from used journal box waste to Bently Brothers, Inc., Milwaukee. A contract has been let to the Journal Box Servicing Corporation, Indianapolis, Ind., for the equipment to be employed in the renovation process. The total cost of the plant will be about $100,000.

THE NORTHERN PACIFIC will immediately start a car rebuilding program which involves 3,000 freight cars and an expenditure of $4,500,000. The program includes the rebuilding of 1,000 refrigerator cars and 1,000 box cars, and the conversion of 500 coal cars into box cars and 500 box cars into livestock cars. The material which will be required to rebuild the cars includes 25,000 tons of fabricated steel, 18,000 ft. of lumber, 2,700 tons of iron and steel castings, 3,000 tons of steel forgings and 6,000,000 sq. ft. of insulating material.

B. & M. Offers Stock to Employees

THE BOSTON & MAINE has offered an opportunity to the 20,000 officers and employees of the Boston & Maine to increase present holdings in the railroad's prior preference stock, and for other employees to become stockholders. For the third time in four years, the Boston & Maine directors have voted to make this 7 per cent cumulative stock available to employees on monthly payments at less than the current market price.

The stock, quoted on the Boston Stock Exchange at about $107 per share, is offered to the employees at $103. Payments in from 16 to 23 months are provided, with 7 per cent interest credited on the purchase price to further reduce the cost, which on the 23 months basis would be only $96.33 per share, according to the announcement. Any officer or employee on the active payroll of the Boston & Maine may subscribe. President French's announcement states that in the first nine months of 1930 the dividend for the whole year was earned more than 2¾ times, notwithstanding the marked decrease in gross revenues during that period.

Railway Employment Statistics

THE NUMBER of railway employees at the middle of September, as reported to the Interstate Commerce Commission, shows a further reduction to 1,485,906, a decrease of 14.98 per cent as compared with last year.

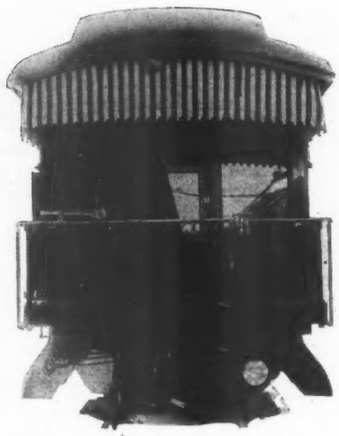
Railways Resume Shop Work

THE NEW YORK CENTRAL has reopened its shops at West Albany, N. Y., East Buffalo, N. Y., Collinwood, Ohio, Depew, N. Y., Avis, Pa., and Harmon, N. Y., which had been closed for three weeks. About 5,300 men have resumed work.

The New York, New Haven & Hartford has put to work 1,750 men in its shops at Readville, Mass., and New Haven, Conn., where much work had been temporarily suspended. At Readville the men will work three days a week and at New Haven five days a week.

Railroads in the Middle west have recently opened or made arrangements to open shops which have been temporarily closed during the period of reduced business. The Chicago, Rock Island & Pacific returned 2,100 men to the shops at Chicago, Silvis, Ill., Horton, Kan., Kansas City, Mo., Shawnee, Okla., and El Reno, Little Rock, Ark., and Fort Worth, Tex., when they were reopened at those points on November 17. The plan was to retain these shop men during the last two weeks of November and probably the first two weeks of December, contingent upon the condition of business.

The Chicago & North Western shops throughout that system reemployed about 4,000 men on a three-days-a-week basis, on November 3. Some of the employees affected had been out of service since September 17. About 700 shop men were added to the forces of the Chicago & Alton shops at Bloomington, Ill., on November 3. On the St. Louis-San Francisco about 1,200 shop employees who had been taken out of service on September 22 were returned to work during the latter part of October and it was expected that they would be in service for the remainder of the year.



The Union Pacific "Family"

THE UNION PACIFIC Family League, which is composed of employees of the Union Pacific, has issued an appeal to its members asking that each contribute one per cent of each month's salary, for five months to provide a fund for the relief of those of its unemployed members who are experiencing financial distress.

Cab Signals on 2,800 Miles

THE PENNSYLVANIA has completed the installation of cab signals on its Pittsburgh Division, Altoona to Pittsburgh, 110 miles. The total length of its tracks on which the cab signal system is now in operation (including lines on which automatic train control has been installed by order of the government) is 2800 miles.

Long Locomotive Runs

A RUN OF 181 miles without change of engine will be established by the Central Vermont within a short time when the first Central Vermont freight locomotives of the 700 class will commence running through to Brattleboro, Vt., from St. Albans. The locomotives will run through two states, New Hampshire and Vermont, without a change and with two crews—one from Brattleboro to White River Junction, 64 miles, and the second from White River Junction to St. Albans, 117 miles.

The Boston & Maine has inaugurated a continuous locomotive run of 338 miles between Boston, Mass., and Montreal, Que.

Railway Wage Negotiations in Great Britain

NEGOTIATIONS are now under way in Great Britain in connection with recent proposals of the railways to reduce the wages of their employees. The proposed reductions, according to recent newspaper reports, involve a general wage cut of about $1.50 a week with a minimum wage of about $9.50 instead of the present minimum which is equivalent to $10.

The present situation in these wage negotiations traces back to August, 1928, when the railway employees voluntarily accepted a cut of 2½ per cent for a period of one year; it was hoped that the

savings thus effected would aid the financial rehabilitation of the railways. When this agreement expired it was extended for another six months as from November, 1929, with the stipulation that upon the expiration of this extension in May, 1930, the old wage scale would be restored and that neither the railways nor the employees would call for further revision of wages until November 12, 1930. Thus with the passing of this latter date negotiations are again re-opened.

M.-K.-T. Repairs Chargeable to Suspense Account

THE INTERSTATE COMMERCE COMMISSION has granted authority to the Missouri-Kansas-Texas and the M-K-T of Texas, similar to that recently granted the Chicago & North Western, to enable it to charge to suspense account approximately $200,000 to be expended in heavy repairs to equipment not in service during December, to relieve the unemployment situation, and to charge this sum to operating expenses when the equipment is returned to service.

Systematic Aid to Employees Out of Service

SOLICITATIONS OF officers and employees for contributions to aid former employees who have been released from service during the present economic depression and are in temporary need has been undertaken by a number of railroads, including the Chicago, Burlington & Quincy; the Chicago & North Western; the Chicago, Milwaukee, St. Paul & Pacific; the Chicago, Rock Island & Pacific and the Pennsylvania.

The relief plan on the Rock Island has been in operation since October 22 and during the first two weeks contributions totaled about $35,000. In addition to the fund for former employees, the Pennsylvania is soliciting funds for charity organizations to be used in aiding unemployed outside of the railroad organization.

The relief organization established on the Milwaukee is typical of that in operation on each of the other four roads mentioned. Contributions solicited from each officer and employee of the railroad are deposited with the company treasurer, either in cash or by payroll deduction, and are administered by an executive relief committee which is headed by the vice-president in charge of operation. Other members of this executive committee include the first vice-president of the Milwaukee Road's Women's Club, the vice-presidents of finance and traffic, the chief purchasing officer, and the system general chairmen of the brotherhoods—the car men, the clerks, the telegraphers and the maintenance of way men. In addition the organization will consist of terminal and divisional committees which will have as members one or more representatives of the local labor unions and the division superintendent, master mechanic and the storekeeper.

These committees will make a survey of the needs of families and approve applications for aid when sponsored by the supervisory officer under whom the former employee last served. Supplies for distribution will be purchased at the lowest possible price by the Milwaukee's purchasing department and transported free over the railroad's lines.

On the Burlington the contributions to this fund will be made monthly until May 1, 1931, while on the Milwaukee the plan will be operative for five months, and on the North Western it will be in effect until such time as it is considered that the emergency has passed. The relief organization on the North Western includes a clothing committee in charge of the general claim agent, which will collect and distribute clothing, and a jobs committee in charge of three of the railroad's officers, which will act as an employment agency to provide work for former employees in other capacities than on the railroad.

Letter Ballot Returns

The recommendations of several of the committees reporting at the Mechanical Division convention at Atlantic City, N. J., June 18 to 25, 1930, inclusive, were ordered submitted to a letter ballot of the members. The returns, recently tabulated, show the two-thirds majority requisite for approval of all of the recommendations advanced. The propositions to amend the standard and recommended practice of the division are accordingly approved, effective March 1, 1931; also the propositions to amend the loading rules of the division are approved, effective January 1, 1931.

Arbitration Committee.—The recommendation of this committee was confined to a single proposition to adopt as recommended practice the revised supplementary regulations governing inspection and repairs of foreign cars and billing for these repairs.

Brakes and Brake Equipment.—The recommendations of this committee were divided into four propositions: To change the standard for triple valve graduating spring; to revise the recommended practice for steam and air connections for passenger cars, page 79-1926, Sec. E of the Manual; to revise the general air brake arrangement and details, page 13, Sec. E of the Manual, to cover extra heavy pipe; to revise the drawing for brake head, page 84-1929, Sec. E of the Manual.

Car Construction.—The recommendations of this committee were divided into four propositions: To revise the specifications for journal boxes; to adopt as recommended practice definitions and designating letters for pulp wood cars; to revise drawings for journal bearing wedges and gages; to adopt alternate lumber sections as recommended practice.

Couplers and Draft Gears.—The recommendations of this committee were divided into two propositions. To adopt as recommended practice specifications for separate followers; to adopt as recommended practice the Type E coupler. (Plates A, B, C, D and E).

Electric Rolling Stock.—The recommendation of this committee was confined to a single proposition to adopt as recommended practice a standard method of rating electric locomotives.

Loading Rules.—The recommendations of this committee were divided into 28 propositions in the letter ballot and three propositions in the supplementary letter ballot to modify the A. R. A. loading rules.

Locomotive and Car Lighting.—The recommendations of this committee were divided into three propositions: To revise the recommended practice schedule of incandescent lamps; to revise the recommended practice specification for axle generator equipment; to restore to the Manual the recommended practice for locomotive lighting.

Locomotive Design and Construction.—The recommendations of this committee were divided into four propositions: To adopt as recommended practice the

Domestic Orders Reported During November, 1930

Locomotives

Name of Company	Number ordered	Type	Builder
Litchfield & Madison	2	2-8-2	American Loco. Works
Chicago & Illinois Midland	2	2-10-2	Lima Loco. Works
Total for month	4		

Freight Cars

Name of Company	Number cars ordered	Type	Builder
Reading	20	Caboose	Company shops
Virginian	600	Hopper	Virginia Bridge & Iron Co.
Baltimore & Ohio	1000	Gondola	Company shops.
Chicago & North Western	100	Trap	Company shops.
	4	Flat	Company shops.
Missouri Pacific	168	Box	Company shops.
	625	Gondola	Company shops
Chicago Great Western	300	Hopper	Pullman Car & Mfg. Co.
Standard Refrigerator Car Company	45	Refrigerator	English Car & Mfg. Co.
Total for month	2862		

Passenger Cars

Name of Company	Number cars ordered	Type	Builder
Atchison, Topeka & Santa Fe	10	Horse palace	Pullman Car & Mfg. Co.
Total for month	10		

standardization of pipe unions of the nut and nipple type; to modify recommended practice formula for computing the tractive effort of the locomotive booster; to adopt as recommended practice, brackets and other means of support for air pumps, water pumps, power reverse gears, feedwater heaters, etc., on locomotives; to adopt as recommended practice, pressures for applying steam chest and cylinder bushings.

Lubrication of Cars and Locomotives.—The recommendations of this committee were divided into three propositions: To revise the specifications for renovated oil; to adopt as standard practice the method for analysis of reclaimed waste; to revise specifications for new waste for journal box packing.

Specifications and Tests for Materials.—The recommendations of this committee were divided into five propositions: To revise the specifications for helical springs; to revise the specifications for chain; to revise the specifications for axle light belting; to revise the specifications for refined wrought iron bars; to adopt as recommended practice, specifications for unions and combination union fittings, black and galvanized, for 300 lb. pressure.

TANK CARS.—The recommendations of this committee were divided into 17 propositions to adopt revisions in certain details of the A. R. A. tank car specifications.

Wheels.—The recommendation of this committee was confined to one proposition which was to adopt symbols for wheel defects.

Railway Expenditures Are Largest Since 1923

Nine months total of $698,821,000 is 22 per cent above 1929 outlay

CAPITAL EXPENDITURES of the Class I railroads for new equipment and additions and betterments were the largest in the first nine months of 1930 for any corresponding period since 1923, according to an announcement on November 20 by R. H. Aishton, chairman of the executive committee of the Association of Railway Executives, in connection with the annual fall meeting of the member roads of the association in New York.

Capital expenditures actually made in the first nine months of 1930 totaled $698,821,000, an increase of $125,001,000 or approximately 22 per cent above those of the same period in 1929, and an increase of $198,654,000 or 39.7 per cent above those of the corresponding period in 1928.

The amount expended for capital account in the first three-quarters of 1930 exceeded by $69,728,000 or 11.1 per cent the capital expenditures in the first nine months of 1926, which, prior to this year had been the greatest for any corresponding period since 1923.

Of the $698,821,000 actually expended for capital account in the nine months period this year, $272,825,000 was for new equipment, while $425,996,000 was expended for roadway and structures.

Capital expenditures for locomotives in the first nine months amounted to $66,043,000, an increase of $21,356,000 above similar expenditures made in the corresponding period in 1929. For freight cars, expenditures so far this year have amounted to $162,356,000, an increase of $36,270,000 over the same period last year, while for passenger train cars, the railroads have spent $33,270,000 so far this year, or an increase of $5,758,000 above the nine months period of 1929. For other equipment, expenditures amounted to $11,156,00, compared with $12,404,000 in the same period last year.

For shops and engine houses, including machinery and tools, capital expenditures so far this year have amounted to $24,127,000 compared with $23,838,000 in the same period in 1929. Capital expenditures for bridges, trestles and culverts for the first three-quarters of 1930 amounted to $44,384,000. In the same period last year, $43,253,000 were spent for the same purpose. For signals and interlockers, including telegraph and telephone lines, automatic train control, and other similar improvements, the railroads in the first nine months of the current year spent $28,998,000, an increase of $8,766,000 above expenditures for similar items one year ago. For all other improvements $121,573,000 have been expended so far this year, compared with $90,918,000 for the same period one year ago.

Capital expenditures actually made in the first nine months of each year beginning in 1924, when reports by quarters were first received, follow:

Date	Equipment	Roadway and structures	Total
1924	$346,091,000	$264,813,000	$610,904,000
1925	255,893,000	279,141,000	535,034,000
1926	271,023,000	358,070,000	629,093,000
1927	204,992,000	365,223,000	570,215,000
1928	165,967,000	334,200,000	500,167,000
1929	210,689,000	363,131,000	573,820,000
1930	272,825,000	425,996,000	698,821,000

Elimination of 1931 Mechanical Conventions Requested

In a letter recently received by the secretaries of the various railway mechanical department associations which usually hold annual meetings or conventions in the spring and in the fall of the year, the General Committee of the Mechanical Division, American Railway Association, requests that these meetings be eliminated for 1931. In view of present general business conditions, particularly as affect the railroads, the General Committee states that the Mechanical Division will curtail its own annual meeting for 1931 and eliminate the meetings of as many committees as possible, restricting others to one or two meetings. The letter also announces the appointment of a subcommittee consisting of J. Purcell, assistant to the vice-president, Atchison, Topeka & Santa Fe, Chicago, E. B. Hall, general superintendent of motive power and machinery, Chicago & North Western, Chicago, and F. R. Mays, general superintendent of motive power, Illinois Central, Chicago. "to develop what consolidations can be made in the various railway mechanical conventions in the interests of economy and improved handling of mechanical subjects." It is planned to hold meetings of this subcommittee and of representatives of the various mechanical associations early in 1931 to consider this problem.

National of Mexico Reorganizes Mechanical and Stores Work

AS A PART of its program of reorganization inaugurated recently the National of Mexico has placed its stores department under the jurisdiction of its purchasing agency. It is expected considerable savings will result from this consolidation as compared with the former arrangement under which each department was operated independently. Changes made in the purchasing department are expected to effect savings of about $480,000 during the next four months.

It is proposed also to effect savings by the reorganization of the shops on the system. All classified repairs now being taken care of at Chihuahua, Chih., Durango, Dgo., Gomez Palacio, Dgo., and Guadalajara, Jal., and Class 5 repairs being done at San Luis Potosi, S. L. P., will be concentrated at Aguascalientes, Ags., and operations in the shops at the first four points will be confined to the handling of light and running repairs. In the same way classified repairs now being handled at Monclova, Coah., will be transferred to Monterrey, N. L., and those handled at Acambaro, Gto., Buenavista, D. F., and Peralvillo will be transferred to Nonoalco, D. F. The shop work formerly handled at Piedras Negras, Coah., has already been transferred to Monterrey. It is planned to complete the construction of a boiler shop and other improvements at Monterrey at a cost of about $250,000, while proposed shop extensions at Nonoalco are estimated to involve an expenditure of about $400,000.

It is also planned to concentrate at San Luis Potosi all classified repairs now being handled at Dona Cecilia, Tam., and Cardenas, S. L. P. In the future it is thought that the lengthening of locomotive runs, an increase in the mileage between shoppings, a reduction in non-essential repairs, and a reduction of the motive power units in service will make it possible to confine all heavy repairs to only three main shops, those at Aguascalientes, Monterrey and Nonoalco.

In addition to the present personnel department, the National Railways have established a labor committee whose function will be to study recommendations and suggestions made by the labor unions which have contracts with the railways. This committee will function in connection with the proposed reduction of forces, considering protests made by the unions that feel that the rights and seniority of their members are being adversely affected.

Labor contracts signed by the management and the unions recently provide for the pensioning on full salary of employees who have completed 35 years of service with the National Railways. Heretofore only 50 per cent of the salary was allowed as a pension to those who had completed 35 years of service, or were disabled.

Supply Trade Notes

A. E. BIDDLE has been appointed executive vice-president of the Universal Draft Gear Attachment Company, with headquarters at Chicago.

THE JONES & LAUGHLIN STEEL CORPORATION plans the construction of a one-story storage and distributing unit at Chicago to cost $100,000.

EDWARD J. FAGAN, representative of the Midway Railway Equipment Company, Chicago, has been elected president to succeed Eugene Weiss, Jr., resigned.

THE CLEVELAND PNEUMATIC TOOL COMPANY, Cleveland, Ohio, has moved its Philadelphia office from the Bourse building to the Terminal Commerce building.

C. A. WILMOT, representative of the Wickwire Spencer Steel Company, with headquarters in New York, has been appointed assistant sales manager in charge of structural products, with headquarters at Chicago.

CLYDE C. ELMES has been elected vice-president and general manager of The Dallett Company, Philadelphia, Pa., manufacturers of pneumatic tools, machinery and electric equipment. Previous to Mr. Elmes' new appointment he was superintendent of the Baldwin Locomotive Works.

G. S. TURNER, president of the T-Z Railway Equipment Company, Chicago, has also been elected president of the Morris B. Brewster Company, which has moved its offices to 14 East Jackson boulevard, Chicago.

E. H. WEIGMAN, master car builder of the Kansas City Southern at Pittsburgh, Kans., has resigned to become assistant to vice-president of the Grip Nut Company, Chicago, with jurisdiction over all territory west of Chicago. Mr. Weigman was born on July 29, 1892, at De Soto, Mo. He began his railroad career in 1909 as a car repairer on the Louisville & Nashville at East St. Louis, Ill., and was employed in various capacities in the car department of the Terminal Railroad Association of St. Louis, the Missouri Pacific Lines, the Great Northern, and the Northern Pacific. In April, 1913, he became traveling representative of the car department of the Atlantic Coast Line, with headquarters at Wilmington, N. C., and in February, 1917, assistant secretary of the Master Car Builders and American Railway Master Mechanics Associations (now the Mechanical Division, American Railway Association) with headquarters at Chicago. On August 1, 1917, he was appointed supervisor of car repairs of the Louisville & Nashville at Louisville, Ky., and since October 1, 1925, has served as master car builder of the Kansas City Southern at Pittsburg, Kans.

E. J. BLAKE, formerly engineer in charge of the car lighting section of the American Brown Boveri Corporation, Camden, N. J., has resigned to engage in private consulting engineering work with offices at 123 South Broad Street, Philadelphia, Pa. Special attention will be given to investigation and development of regulating and control systems, new devices, processes and manufactured

E. J. Blake

products. Mr. Blake was born in Newark, N. J. He was graduated from Princeton University in 1901 and served his apprenticeship in the student courses of the Westinghouse Electric & Manufacturing Company and the General Electric Company. In 1904, he entered the electrical department of the New York Central and for ten years was engaged in a variety of work in connection with the electrification of the New York Zone. In 1914 he entered the railway supply field as electrical engineer for the Hall Switch & Signal Company. Three years later he joined the Gould Coupler Company as electrical engineer and continued in this capacity until 1928 when the company went out of the car lighting business, at which time he became associated with the American Brown Boveri Corporation as general engineer in charge of car lighting, oil circuit breakers and miscellaneous apparatus. Mr. Blake is the inventor of a number of railway signals, automatic train control and car lighting devices.

R. W. THOMPSON, advertising manager and manager of cut nail sales of the Reading Iron Company, and manager of sales for the Stoyestown Coal Mine, a subsidiary, has been appointed also director of public relations; Harold S. Bard, for seven years a salesman of the former company with headquarters in the New York district, has been appointed district sales representative, with office at 1714 Engineering building, Chicago, succeeding R. A. Griffin, resigned. A. M. Cullum, oil country sales manager at Tulsa, Okla., has resigned to become associated with the Harbison-Walker Refractories Company, Pittsburgh, Pa.

JOHN F. NULTY has been appointed Eastern District Manager for the Railway Centrifix Corporation, Cleveland, Ohio, with headquarters at 340 Mt. Airy avenue, Philadelphia. Previous to his appointment Mr. Nulty was associated with the Baldwin Locomotive Works.

THE HARBISON-WALKER REFRACTORIES COMPANY, Pittsburgh, Pa., has completed a 5,000-ft. motion picture illustrating modern methods employed in the manufacture of refractories. The film shows every step in the production of refractories from the mining of raw materials to the loading and shipping of the finished product. Scenes in the research and control laboratories, and some interesting animated photography showing the action of periodic and continuous tunnel kilns are also included in the picture.

The film is available, without cost, to technical societies, engineering organizations, industrial organizations, universities, colleges, technical schools and research laboratories. It is suggested that early applications be made to Harbison-Walker Refractories Company, 1800 Farmers Bank building, Pittsburgh, Pa.

DR. VICTOR O. HOMERBERG has been appointed technical director of the Nitralloy Corporation, New York, which company controls, through assignment by Aubert &

Dr. Victor O. Homerberg

Duval, Frers., Paris, France, the United States patents issued to Dr. Adolph Fry of the Friedrich Krupp Aktiengesellschaft, Essen, Germany, and many other patents and applications relating to the production of steels destined for nitriding and the art of nitriding. Dr. Homerberg is associate professor of physical metallurgy at the Massachusetts Institute of Technology, at which institute he received his bachelor of science degree in chemical engineering and doctor of science degree in metallurgy. He is the author and co-author of articles pertaining to physical metallurgy or metallography and co-author of the text book Principles of Metallography. He has been consulting metallurgist for a number of manufacturing concerns and engaged in research pertaining to the nitriding process. He is chairman of the publications committee and of the subcommitteee on nitriding of the American Society for Steel Treating.

J. H. WILLIAMS & Co., manufacturers of drop forgings and drop-forged tools, have closed contracts for an addition to their plant at Buffalo, N. Y. The extension will provide an increase of approximately 30,000 sq. ft. in floor space to be used for additional heat-treating facilities and also for finishing, assembling and storing standard stock products.

P. N. GUTHRIE, JR., vice-president in charge of sales of the Reading Iron Company, has been elected president to succeed Leon E. Thomas, who resigned as president in July of this year. Since that time A. J. Maloney, chairman of the board, performed the executive duties of president, which are now turned over to Mr. Guthrie. Mr. Guthrie was born on April 26, 1876, at Pittsburgh, Pa., where he attended public and private schools. He began work in the employ of Park

Presly Neville Guthrie, Jr.

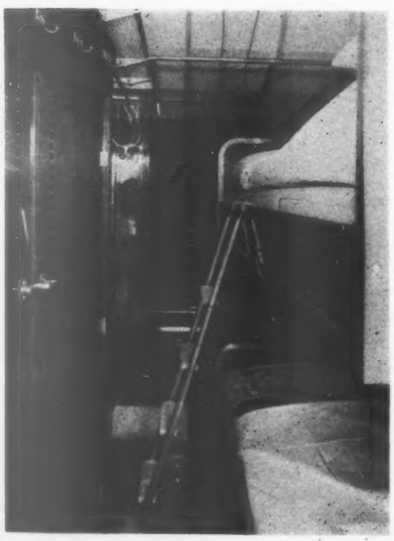
Brothers & Company, Pittsburgh, Pa., who owned and operated the Black Diamond Steel Works. He later served consecutively with the Philadelphia Company of Pittsburgh and was superintendent of the Hornell Gas Light Company, Hornell, N. Y., then as general manager of Chemung County Gas Company, Elmira, N. Y. He has had considerable experience in the management and operation of natural gas utilities in five of the eastern states in this country. Mr. Guthrie returned to the iron and steel business and served for several years as sales agent and general manager of sales for the Longmead Iron Company, Conshohocken, Pa., manufacturers of wrought iron pipe. In 1909 he went to the South Chester Tube Company, Chester, Pa., in charge of sales. He was granted leave of absence in July, 1917, and entered the government service as assistant director, Bureau of Oil Well Supplies, Oil Division, United States Fuel Administration, and in February, 1919, at the end of the war, returned to the South Chester Tube Company as manager of sales, from which position he resigned in December, 1928, to become vice-president in charge of sales of the Reading Iron Company. He now becomes president of the company.

THE CARRIER ENGINEERING CORPORATION of Newark, N. J., the Brunswick-Kroeschell Company of New Brunswick, N. J., and Chicago, and the York Heating & Ventilating Corporation of Philadelphia, Pa., manufacturers of air conditioning, refrigerating and unit heating and ventilating equipment, have been consolidated. The merger, including subsidiary and affiliated concerns, unites fifteen companies, with total assets of approximately $15,000,000, and provides an organization equipped to produce any desired kind of atmospheric conditions in homes, office buildings, industrial plants, etc. According to the plans contemplated, each of the companies involved will retain separate entities under a holding company to be known as the Carrier Corporation. All research, direct sales and engineering activities for the group will be conducted through this corporation.

JOHN T. BRENNAN, assistant vice-president in charge of sales of the Greenville Steel Car Company, Greenville, Pa., has been elected vice-president in charge of sales to succeed Kenneth C. Gardner, resigned. Mr. Brennan has been in the employ of the company for the past 15 years, serving successively as purchasing agent and for the past several years as assistant vice-president in charge of sales.

THE NATIONAL ALUMINATE CORPORATION of Chicago has purchased the chemical products business of the Paige & Jones Chemical Company, N. Y., and will operate this company as a division of the National Aluminate Corporation under the name of the Paige-Jones Chemical Company. The executive offices of the latter company will be at 6216 West Sixty-sixth place, Chicago.

* * *



New type of second-class sleeping compartment, Swedish State Railways

Sleeping cars divided into compartments of the type shown here are to go into use on the Swedish State Railways in the near future. Since they will be operated between Stockholm and Malmö, Stockholm and Gothenburg, and on other one-night runs where day occupancy of the cars is not required, it has been possible to gain a maximum of comfort by designing compartments exclusively for night travel. The cars also have first class compartments similar to the one shown above, but with only one berth.

THE H. E. EATON COMPANY, 50 Church street, New York, has been appointed a representative of the Davis Boring Tool Company in the territory of New York City which comprises also New Jersey and a part of Massachusetts. The Evans Tool Company, 335 South Central avenue, Los Angeles, Cal., and Wessendorf, Nelms & Co., 317 Preston avenue, Houston, Tex., have also been appointed representatives of the Davis Company in Los Angeles and Southern California and Texas and Louisiana, respectively.

M. J. CZARNIECKI has been appointed to the newly created position of manager of tubular sales of the A. M. Byers Company, Pittsburgh, Pa. Mr. Czarniecki joined the Pittsburgh sales organization of A. M. Byers Company in 1913 and the following year was assigned to the New York office where he remained until his transfer in 1915 to Chicago. After the war in 1918 he returned to Chicago as district manager and the following year was transferred to New York where he remained as district manager until 1925, when he was appointed assistant general manager of sales with headquarters in Pittsburgh, Pa.

S. L. POORMAN, representative in New England of the Westinghouse Air Brake Company, Wilmerding, Pa., has changed his headquarters from Boston to New York; John W. Henry, mechanical expert formerly at Washington, D. C., has been transferred to the eastern district with headquarters at New York; C. O. DeWitt has been transferred from the engineering department in Wilmerding to the New York office as assistant to the district engineer; T. W. Baldwin has re-entered the employ of the company as mechanical expert at St. Paul, Minn., and D. R. Collins, formerly a locomotive engineman on the Denver & Salt Lake, has been appointed mechanical expert with headquarters at Denver, Colo.

Obituary

HENRY LANG, vice-president of the Ingersoll-Rand Company, New York, died at his home in Montclair, N. J., on November 10, at the age of 66.

EDWARD CONRAD WALDVOGEL, a director and vice-president of the Yale & Towne Manufacturing Company, Stamford, Conn., died at his home in New Rochelle, N. Y., on November 13. Mr. Waldvogel was born at Toledo, Ohio, and entered the Yale service in 1905 as a traveling salesman. In 1910 he was transferred to New York as assistant to the general manager and in 1912 appointed assistant general manager. He succeeded Walter C. Allen, the present president of the company, as general manager in 1916, and in March, 1920, was elected a director of the Yale & Towne Manufacturing Company. On March 8, 1923, Mr. Waldvogel was appointed vice-president with the division of sales as his particular directive work. He retired from active directive service on April 1, 1930, but still remained a director and vice-president.

Personal Mention

General

KARL BERG, assistant superintendent motive power of the Pittsburgh & Lake Erie and the Lake Erie & Eastern, has been promoted to the position of superintendent motive power, with headquarters at Pittsburgh, Pa., as before.

ROBERT HUNT has been appointed assistant general superintendent, motive power, of the Seaboard Air Line, with headquarters at Norfolk, Va., and the position of mechanical engineer, in which capacity he served before, is abolished. Mr. Hunt was born at Manchester, Eng-

Robert Hunt

land, on February 16, 1888. Mr. Hunt received his education at the Manchester high school and from 1903 to 1909 attended evening classes at the Manchester Technical College. He entered railroad service with the Great Central Railway (now part of the London, Midland & Scottish), as apprentice draftsman. In 1909 he entered the service of the Atlantic Coast Line, remaining with that company until 1918, and holding the positions of draftsman and chief draftsman successively during that period. He became connected with the Seaboard Air Line in 1918 and served as chief draftsman until 1920, when he was advanced to mechanical engineer, which position was abolished at the time of Mr. Hunt's recent promotion to assistant general superintendent, motive power.

GEORGE W. IMGRUND, master mechanic of the Chicago & Illinois Midland, has been appointed superintendent of motive power and equipment, with headquarters as before at Taylorville, Ill., following the consolidation of the locomotive and car departments of that railroad. Mr. Imgrund was born on February 18, 1883, at Springfield, Ill., and entered railway service at the age of 13 years as a machinist apprentice on the Wabash. Four years later, when he completed his apprenticeship on the Wabash, he became a machinist for a manufacturer at Springfield, re-entering railway service in 1902 as a machinist on the Baltimore & Ohio at Newark, Ohio. From December, 1902, until February, 1927, he served successively as engine-house foreman on the Baltimore & Ohio at Lorain, Ohio, and New Castle, Pa.; as mechanical inspector on the Lake Shore & Michigan Southern

George W. Imgrund

(now a part of the New York Central); as a machinist, erecting foreman at Springfield, as enginehouse foreman at Chicago and Decatur, Ill., and as general foreman of the locomotive and car departments of the Wabash and as master mechanic of the Chicago, Peoria & St. Louis at Jacksonville, Ill. On February 1, 1927, Mr. Imgrund was appointed master mechanic of the Chicago & Illinois Midland.

Master Mechanics and Road Foremen

W. W. WELLS has been appointed master mechanic of the Midland Continental at Jamestown, N. D.

J. P. DRISCOLL has been appointed master mechanic of the Erie, with headquarters at Jersey City, N. J.

C. J. GERBES has been appointed master mechanic of the Erie, with headquarters at Secaucus, N. J., succeeding J. P. Driscoll.

B. E. JONES, supervisor of motor cars at New York, has been appointed master mechanic of the Erie, with headquarters at Hornell, N. Y.

R. H. CLINE has been appointed master mechanic of the Monongah division of the Baltimore & Ohio, with headquarters at Grafton, W. Va.

W. G. FIFIELD has been appointed road foreman of engines of the Portland division of the Southern Pacific with headquarters at Portland, Ore.

J. D. HEYBURN has been appointed road foreman of engines of the Eastern division of the St. Louis-San Francisco, with headquarters at Springfield, Mo.

H. B. DRYDEN, locomotive foreman of the Canadian National at Campbellton, N. B., has been appointed acting master mechanic of the Campbellton division, with headquarters at Campbellton.

A. SAUNDERS has been appointed master mechanic of the Hornepayne division of the Canadian National, with headquarters at Hornepayne, Ont., succeeding W. A. McCarthy, deceased.

PAGE CARLISLE, master mechanic of the Campbellton division of the Canadian National, has been appointed master mechanic of the Moncton division, with headquarters at Moncton, N. B.

T. W. MCBEATH, master mechanic of the Moncton division of the Canadian National, has been appointed regional master mechanic, with headquarters at Moncton, N. B., succeeding F. H. Moore, retired.

F. E. COOPER has been appointed assistant master mechanic of the Baltimore & Ohio, with headquarters at Gassaway, W. Va. The Charleston division of the B. & O. has been absorbed by the Monongah division.

M. L. CRAWFORD, assistant master mechanic of the Northern division of the St. Louis-San Francisco at Monett, Ark., has been promoted to the position of master mechanic of the Central division, with headquarters at Fort Smith, Ark.

R. G. MILLER, master mechanic of the Slaton division of the Atchison, Topeka & Santa Fe, has been transferred to the Pecos division, with headquarters at Clovis, N. M., succeeding W. W. Walker, who resigned on November 1.

W. F. BRANDT, general foreman of the St. Louis-San Francisco at Springfield, Mo., has been promoted to the position of assistant master mechanic of the Northern division, with headquarters at Monett, Ark.

J. M. NICHOLSON, fuel conservation engineer of the Atchison, Topeka & Santa with headquarters at Topeka, Kan., has been appointed master mechanic of the Slaton division of the Panhandle & Santa Fe with headquarters at Slaton, Tex.

THE JURISDICTION OF F. R. Clapp, master mechanic of the Minnesota division of the Minneapolis, St. Paul and Sault Ste. Marie at Enderlin, N. D., has been extended to include the Missouri River division, replacing F. M. Roberts, who was located at Bismarck, N. D., and who has been assigned to other duties.

Car Department

WILLIAM GOUGE, passenger car foreman of the Canadian National at Toronto, Can., has been appointed superintendent of the car shops at Leaside, Ont., succeeding O. Grant, deceased.

W. J. PARDUE has been appointed master car builder of the Seaboard Air Line, with headquarters at Norfolk, Va. The position of general inspector, freight and passenger equipment, formerly held by Mr. Pardue, is abolished.

HORACE G. MATTHEWS has been appointed acting car foreman of the Canadian National with headquarters at Niagara Falls, Ont., succeeding D. Thompson.

DANIEL THOMPSON, car foreman of the Canadian National at Niagara Falls, Ont., has been appointed car foreman, Toronto, Ont., coach yards.

F. G. MOODY, acting master car builder of the Northern Pacific, has been promoted to master car builder, with headquarters as before at St. Paul, Minn.

W. E. CORR, general foreman, car department, of the Seaboard Air Line, at Savannah, Ga., has been appointed assistant to master car builder, with headquarters at Norfolk, Va.

Shops and Enginehouse

JOSEPH SCHNEEBERGER, assistant shop superintendent of the Chicago & Alton, has been promoted to shop superintendent, with headquarters at Bloomington, Ill. Mr. Schneeberger has been connected with that road for about 25 years. He was born in Bloomington, Ill., and entered railway service in 1903 as a machinist apprentice on the Alton at Bloomington. In 1909, after completing his apprenticeship on that road and serving for a number of years as a machinist, Mr. Schneeberger became a

Joseph Schneeberger

machinist on the Colorado & Southern at Pueblo, Colo., and later on the Union Pacific at Ellis, Kan. Later he returned to the Alton at Bloomington and in 1912 was appointed enginehouse gang foreman. He was transferred to the locomotive shop at Bloomington in 1914, then being promoted to general erecting foreman in 1924. In 1925 he was advanced to general machine foreman and in 1928 to assistant shop superintendent.

L. D. HARRISON, machinist, has been appointed assistant foreman, machine shop, of the Southern, with headquarters at Birmingham, Ala.

G. F. WARD, locomotive foreman of the Canadian National at Mimico, Ont., has been appointed general foreman, with headquarters at Belleville, Ont.

CAMERON MANN, locomotive engineer on the Campbellton division of the Canadian National, has been promoted to the position of acting locomotive foreman, with headquarters at Campbellton, N. B.

R. FERGUSON, locomotive foreman of the Canadian National at Lindsay, Ont., has been appointed locomotive foreman, with headquarters at Mimico, Ont.

F. WILLIAMS, night foreman of the Canadian National at Longue Pointe, Que., has been promoted to the position of locomotive foreman, with headquarters at Lindsay, Ont.

A. R. HOEHN, machinist supervisor of the Southern at Birmingham, Ala., has been promoted to the position of assistant foreman, Finley enginehouse. The position of machinist supervisor has been abolished.

Purchasing and Stores

THE HEADQUARTERS of L. C. Rose, purchasing agent of the Colorado & Wyoming, have been removed from Denver, Colo., to Pueblo.

THE HEADQUARTERS of W. C. Atherton, purchasing agent of the Pere Marquette at Detroit, Mich., has been removed to Cleveland, Ohio.

T. A. DONOVAN has been appointed purchasing agent of the Canadian Pacific, New Brunswick district, with headquarters at St. John, N. B.

R. F. MILLER, general storekeeper of the Oregon Short Line at Pocatello, Idaho, has been appointed district storekeeper of the Oregon-Washington Railroad & Navigation Company, with headquarters at Portland, Ore. The position of general storekeeper at Portland has been abolished.

Obituary

CHARLES H. EMERSON, retired master car builder of the Elgin, Joliet & Eastern, died on October 8 at his home in East Joliet, Ill. Mr. Emerson was born at Limerick, N. Y., on July 6, 1859. His railroad career began on July 14, 1880, with the Iowa Central at Marshalltown, Iowa, where he was employed successively as a blacksmith helper, car repairer and general foreman. In 1901 he became master car builder of the Elgin, Joliet & Eastern at Joliet, retiring from that position on September 1, 1927.

E. O. THEDENS, master car builder of the Chicago & Illinois Midland, with headquarters at Taylorville, Ill., who died on November 9, was born in 1886. He gained his first experience in the construction of cars as a mechanic's helper in the wood erecting shop of the Illinois Car & Equipment Company (now the Pressed Steel Car Company) at Chicago, in July, 1900. During the following five years with that company he served as a mechanic, a timekeeper and a labor cost accountant. From 1904 to 1911 he obtained experience in open-hearth furnace work in the steel mill of the Grand Crossing Tack Company at Chicago, and also served as a millwright and car builder in the plants of a number of car manufacturers and railroads. In 1911 Mr. Thedens was appointed assistant general storekeeper of the Ryan Car Company and in the following year became general car foreman of the Illinois Car & Equipment Company at Hammond, Ind., then serving for a time with the Haskell & Barker Car Company. When the latter company was taken over by the Pullman Car & Manufacturing Corporation he remained in the latter's service, filling a number of positions in the sales and production departments. Mr. Thedens was appointed master car builder of the C. & I. M. in 1926.

JAMES T. WALLIS, assistant vice-president in charge of operation of the Pennsylvania, died suddenly at noon on November 7, at his home in St. Davids, Pa. He was born in New Orleans on June 11, 1868, and attended the University of Louisiana, Georgetown College and Stevens Institute, graduating from the latter in 1891, with the degree of mechanical engineer. He entered railroad service in 1891, as an apprentice in the West Philadelphia shops of the Pennsylvania and

James T. Wallis

was promoted through the successive grades of assistant road foreman of engines, assistant master mechanic, assistant engineer of motive power, master mechanic and superintendent of motive power. In May, 1911, Mr. Wallis was advanced to superintendent of the West Jersey & Seashore and in January, 1912, was appointed general superintendent of motive power with headquarters at Altoona. In March, 1920, he was promoted to the position of chief of motive power, with supervision over the motive power department of the entire system. In this capacity he was also in direct charge of the Pennsylvania's locomotive and car shops at Altoona. He was appointed assistant vice-president in charge of operation in February, 1927. Since October 10, 1922, Mr. Wallis had served as president of the Eastern Railroad Association.

THE CLEANING OF METAL.—Processes for the cleaning of metals, with practical suggestions for their use, are described by Robert W. Mitchell, Ph. D., in a 76-page illustrated booklet issued by the Magnus Chemical Company, Garwood, N. J. The name and address of this company were incorrectly given in the Trade Publications item published in the November issue.

Railway Mechanical Engineer
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TRANSPORTATION LIBRARY

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•More than 2000 feet of Walworth C. N. I. (chrome-nickel-iron) cast pipe were used in the air, water and steam lines for the new Memphis Union Station yards.

•In addition to the normal corrosion caused by the chemical action of cinders and ashes, there is an extraordinary electrolytic activity in the yards, due to stray currents in the ground, making it highly desirable to use pipe little affected by corrosion.

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These cutters and many of their applications are described and illustrated in our Bulletin No. 46 "Ingersoll Equipment for Railroad Shops." We will gladly send you a copy.

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No. 47 "Ingersoll Milling Machines"
No. 48 "Ingersoll Cutter Grinder"
No. 49 "Ingersoll Milling Cutters"

THE INGERSOLL MILLING MACHINE COMPANY » » ROCKFORD ILLINOIS, U.S.A.

Vol. 104, No. 12

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Performance—*Not Price*—Determines Cutter Value

Experience in cutter usage proves that performance, not price, actually determines the value of a cutter.

Cutters, to be economical, must be designed and manufactured to stand up on heavy cuts for long periods of time with few sharpenings. Each sharpening causes expensive delay in machine operation and loss of man time. Cutters, according as they may be good or bad, make savings or excessive costs in production; their influence is far greater than their relatively small purchase price would indicate.

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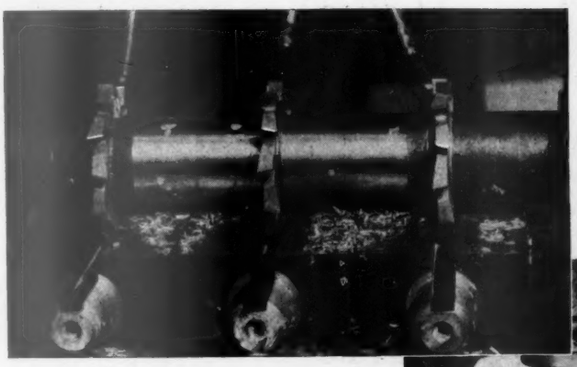
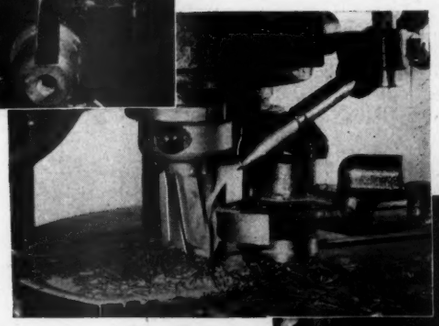
The ability of Brown & Sharpe Cutters to stand up on heavy work—to take more cuts between sharpenings—makes them the best to use on every job. They give lowest *real* cutter cost. Ask for Catalog No. 31 listing the complete line of Brown & Sharpe Cutters. Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.





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Time Lost Removing Cutters
Plus Time Lost Replacing Cutters
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Equals
REAL Cost of Cutters

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Brown & Sharpe Cutters

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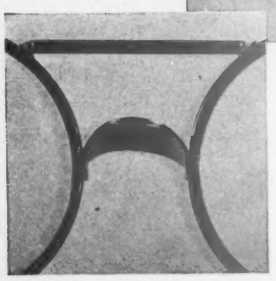
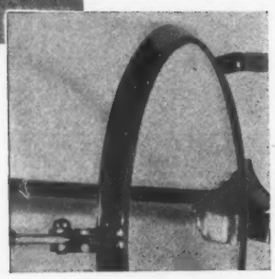


The broad saddle bridge rests comfortably on any nose. It is also greatly strengthened by the brace bar above. Breakage at this point from ordinary use and abuse will seldom occur.



The triangular shaped eye wire which holds the lenses has the same bevel as the glass and acts as a safety flange tending to hold the glass in the frame, if ever struck sufficiently hard to be broken.

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The wide oversize lenses (2 inches in diameter) are of Willson Super-tough glass which is known the world over for its strength and clarity.

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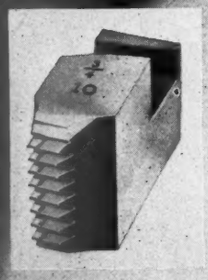

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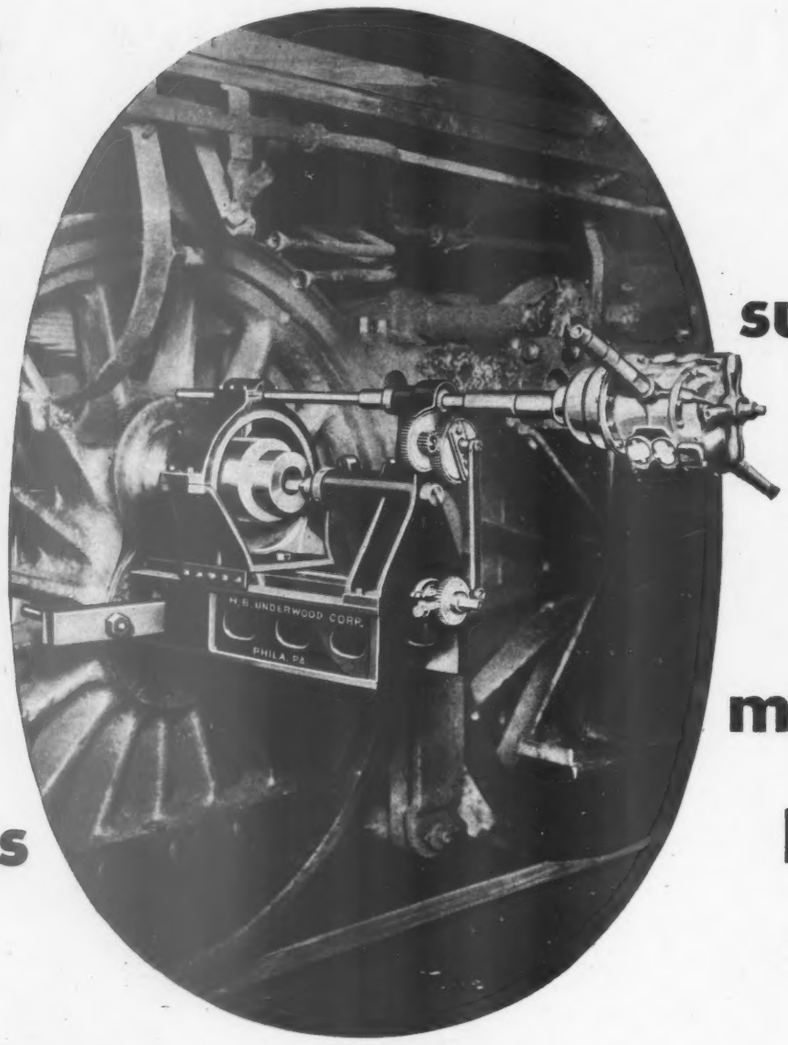

Only the surface to be trued must be bared

THE Underwood Portable Crank Pin Turning Machine offers many opportunities for economies in crank pin repairs.

Worn crank pins reduce locomotive efficiency—yet the expense in removing or filing them is so great that poor service is sometimes put up with until the locomotive can be shopped—even then the expense is high. But not so when you have an Underwood.

You can true up the scored crank pin in the roundhouse—between runs—no need taking engine out of service. It is unnecessary to drop the wheels and press out the pin. Stripping is minimized. Only the surface to be trued must be bared. The Underwood is quickly set up. One or two cuts and the pin is round and true. The locomotive stays in service and you save considerable money for your road.

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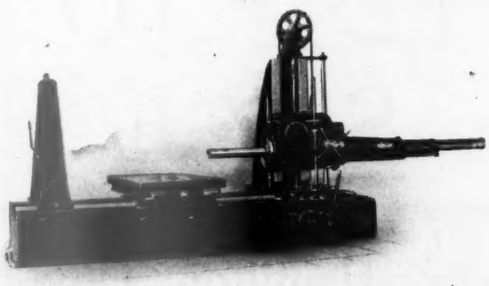
PORTABLE TOOLS

For Locomotive Repair Shops

For Versatility



THIS installation view of the G&L No. 45 Horizontal Boring, Drilling and Milling Machine shows the drilling of a 3/8" diameter hole 8" deep in a combined live and exhaust steam header. This is only one of the drilling, boring and facing operations on this casting.

The versatility of the G&L Method for boring, drilling and facing operations on a large variety of work is quite apparent. It makes a G&L Horizontal Boring, Drilling and Milling Machine the most serviceable tool for a railroad shop.

Specialists in Horizontal Boring, Drilling and Milling

GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN
ESTABLISHED-1859-

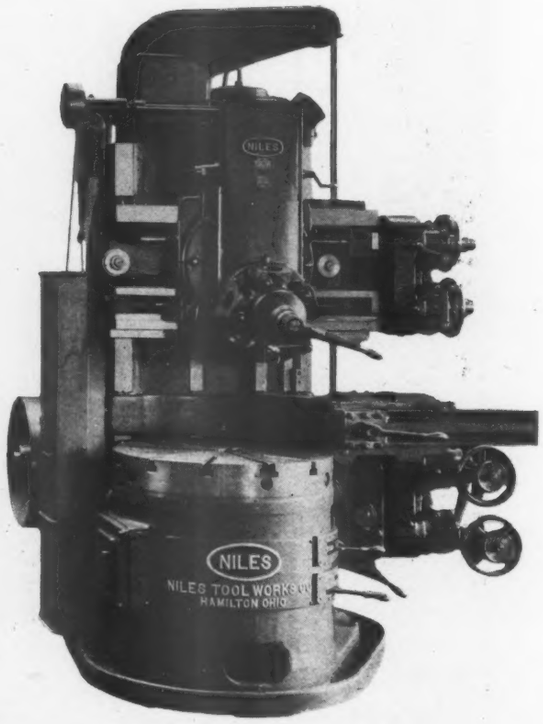
The G&L Method of Boring~Drilling ~and Milling~~

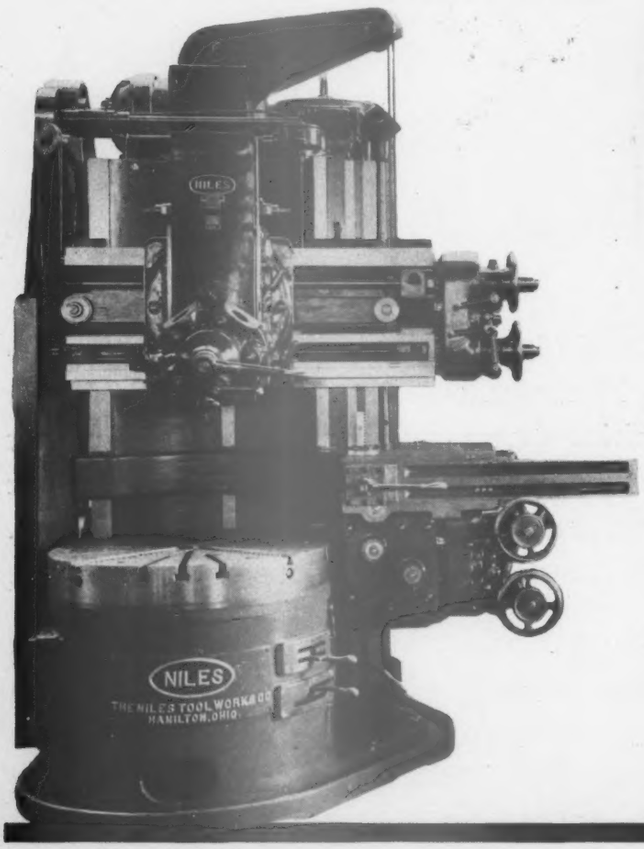
ANNOUNCING

An Addition to the Family

A BIG BROTHER

to the NILES Time Saver
36"-44" Side Head Mill





A....

42"-50"
SIZE

The Niles Tool Works Company, Hamilton, Ohio

Division General Machinery Corporation of Delaware

SALES OFFICES

New York
454 New York Central Bldg.

DETROIT
227 Curtis Bldg.

PITTSBURGH
1723 Grant Bldg.

CHICAGO
1853 Daily News Bldg.

FOREIGN DEPT.—Niles Bement Pond Co., 111 Broadway, N. Y.

SELLING AGENTS

BULLOTTI MACHINERY CO.,
San Francisco, Cal.

MAIR MACH. CORP.,
Houston, Dallas, Texas

HALLIDIE MACHINERY CORP.,
Seattle, Wash.

PRATT AND WHITNEY CO., Los Angeles, Cal., Birmingham, Ala.

NILES

That Troublesome Radial Staybolt Problem

LANDIS TRADE MARK

Solved ! ! ! !

Radial staybolts, to give efficient service, must be free of threading nicks along the body. The tapered thread must also be in time with the straight thread so as to eliminate buckling of the inside and outside plates.

The Landis threading machine fitted with the Landis reverse taper die head and lead screw has solved this troublesome problem for all radial staybolts except the button head type.

Both the straight and tapered threads are cut from the ends in toward the body thus eliminating local corrosion resulting from a nicked body.

The straight and tapered threads can both be cut with the reverse taper die head. A straight cam being employed to generate the straight thread.

Threaded grips timed with the die head by means of the lead screw insure threads which are synchronized or in pitch.

Write today for the complete story. All Landis literature has been revised and is now available. Requests should specify type of die head or machine.

Landis Machine Co., Inc. Waynesboro, Penna.

Detroit Office:
5928 Second Blvd.

Cleveland Office:
504-505 Marshall Bldg.

Agents in all principal cities of the world.

THE TEST

DURING the past three and one-half years the Forging Industry has tested and unmistakably approved the Chambersburg-National idea.

This idea of one united, unbiased engineering and sales service, representing the two leading manufacturers of forging equipment, could succeed only as it contributed to the progress and to the profits of the Forging Industry.

Its endorsement by that Industry can have but one meaning.

CHAMBERSBURG-NATIONAL

COMPLETE FORGING EQUIPMENT

CHAMBERSBURG ENGINEERING CO.
CHAMBERSBURG . . . . . PA.

THE NATIONAL MACHINERY CO.
TIFFIN . . . . . OHIO

CHAMBERSBURG PA. — TIFFIN OHIO

Sales Offices at
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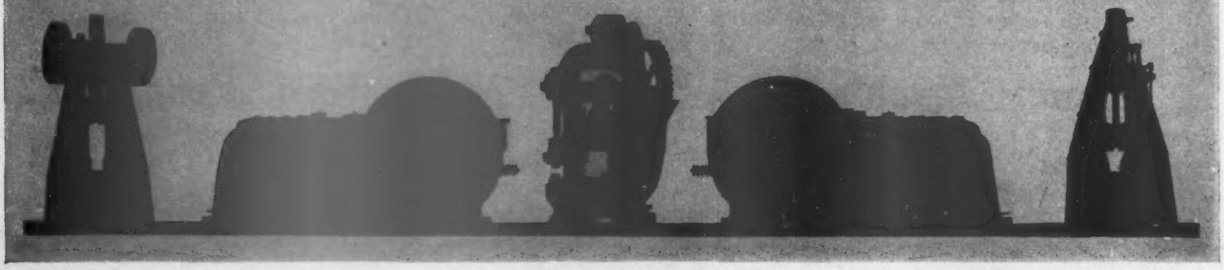
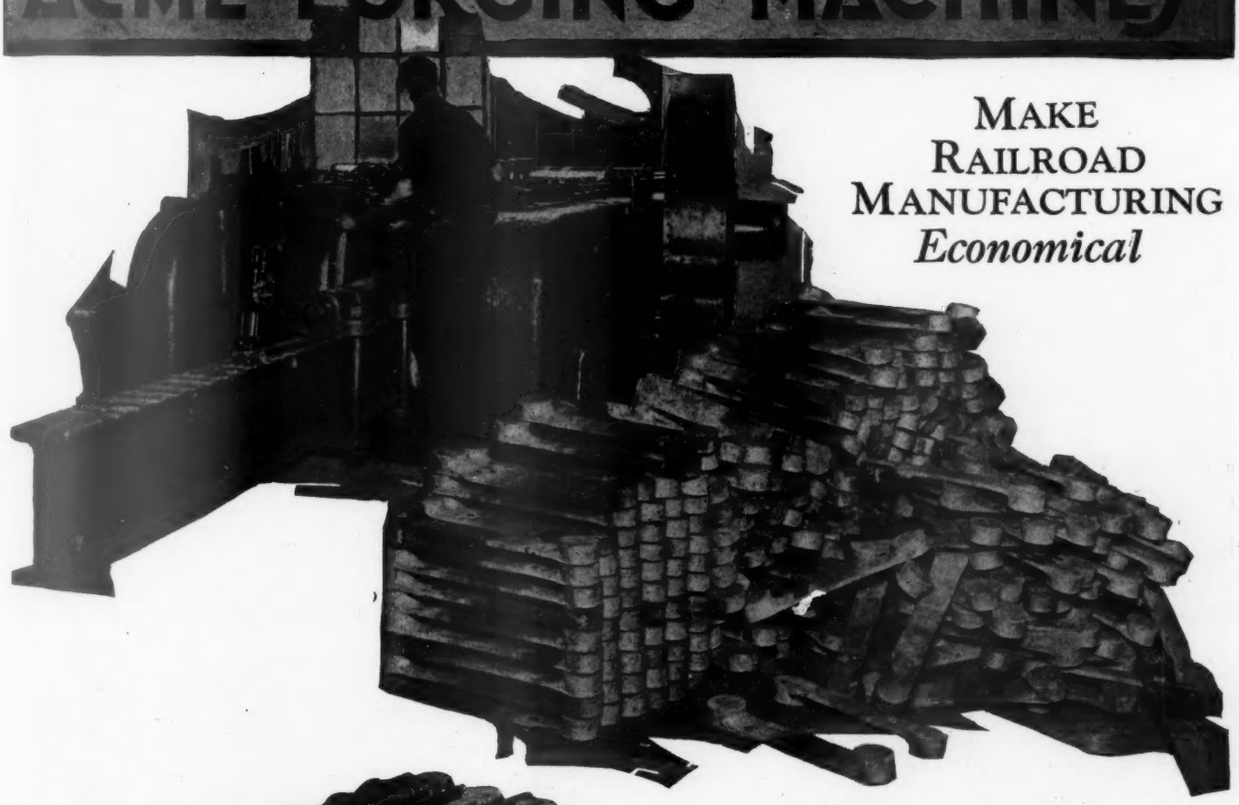
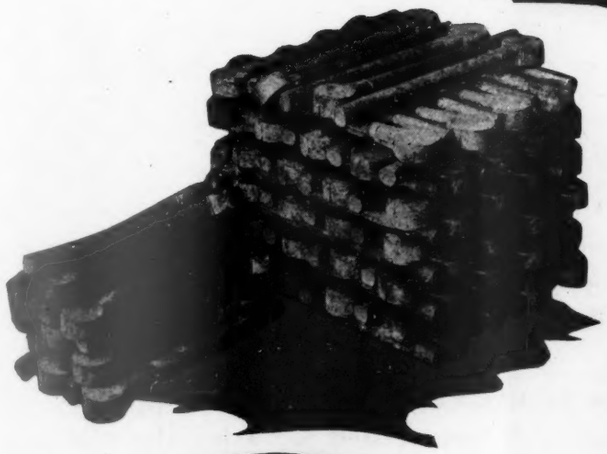
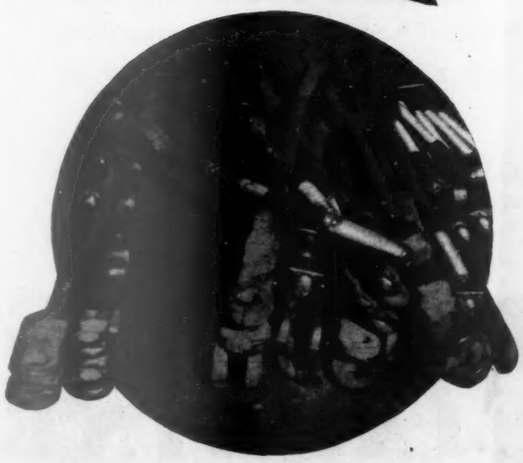


ACME FORGING MACHINES



MAKE
RAILROAD
MANUFACTURING
Economical





PRODUCE
LOCOMOTIVE FORGINGS
AT LOW COST

FORGING your own locomotive parts is extremely economical if you use the Acme Forging Machine. It has a big performance range from ¾" to 5" which enables you to keep the machine busy handling a wide variety of large and small forgings with the least possible delay and at a low unit cost.

The Acme Forging Machine is much more efficient and economical than hammer-smith gangs. You save time, labor and materials. Only one stroke in some cases, and at most a few strokes are required to complete forgings. The parts are forged to close limits and so accurate that grinding and machine work is minimized if not eliminated.

The Acme is ruggedly built of "all steel" construction, combining strength, power and stamina to withstand severe punishment day after day and year after year without undue maintenance.
It's an economy machine any way you look at it.

THE ACME MACHINERY CO.
Cleveland, Ohio
Detroit Office: 5185 Loraine St.

SAVES $13 . . PER AXLE

IN the car blacksmith shops of the Chicago & Northwestern Railroad this 6-inch Ajax Heavy Duty Upsetting Forging Machine is reclaiming scrap car axles at an average saving of $13 per axle. With four strokes in a three high die the machine punches off end collar, elongates the wheel seat, upsets a new end collar and forges the lathe center hole for turning.

Up to 100 axles a day can be reclaimed with an Ajax Upsetting Forging Machine, and where this capacity is not needed for axles the machine can be used for producing a wide range of heavy car and locomotive forgings. Send for Bulletin describing this new and better method of reclaiming scrap car axles.

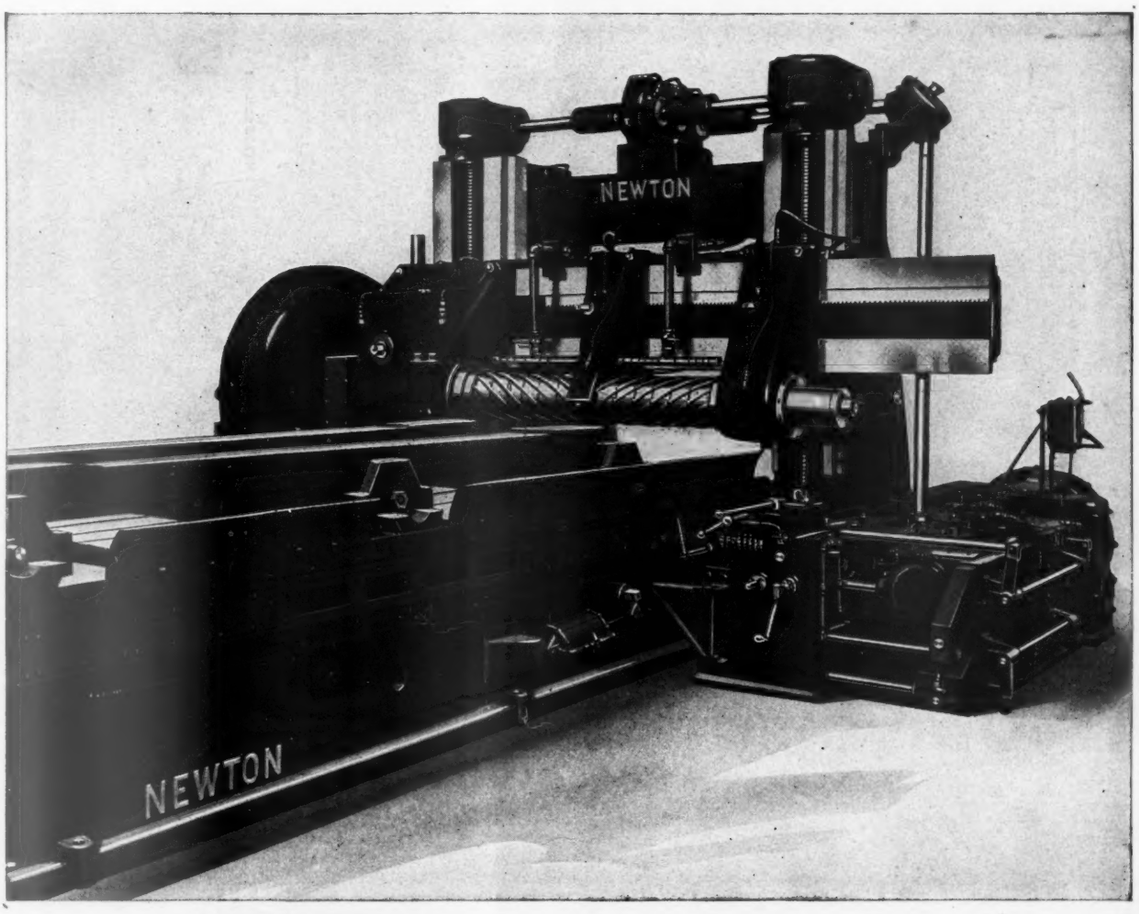
Chicago Office 621 Marquette Bldg.

THE AJAX MANUFACTURING CO.
EUCLID BRANCH P. O., CLEVELAND, OHIO

New York Office 1369 Hudson Terminal

AJAX UPSETTING . . FORGING MACHINE

new



The New **NEWTON** Horizontal Rod Milling Machine with complete Universal Fixtures for slabbing and channeling locomotive rods.

With two rods on the table, using two 4″ width cutters this machine will take the two channeling cuts 1½″ deep at 9″ per minute feed.

If you are interested in the very latest developments in slabbing and channeling rods, write us and we will tell you where you can see one of these new machines in operation.

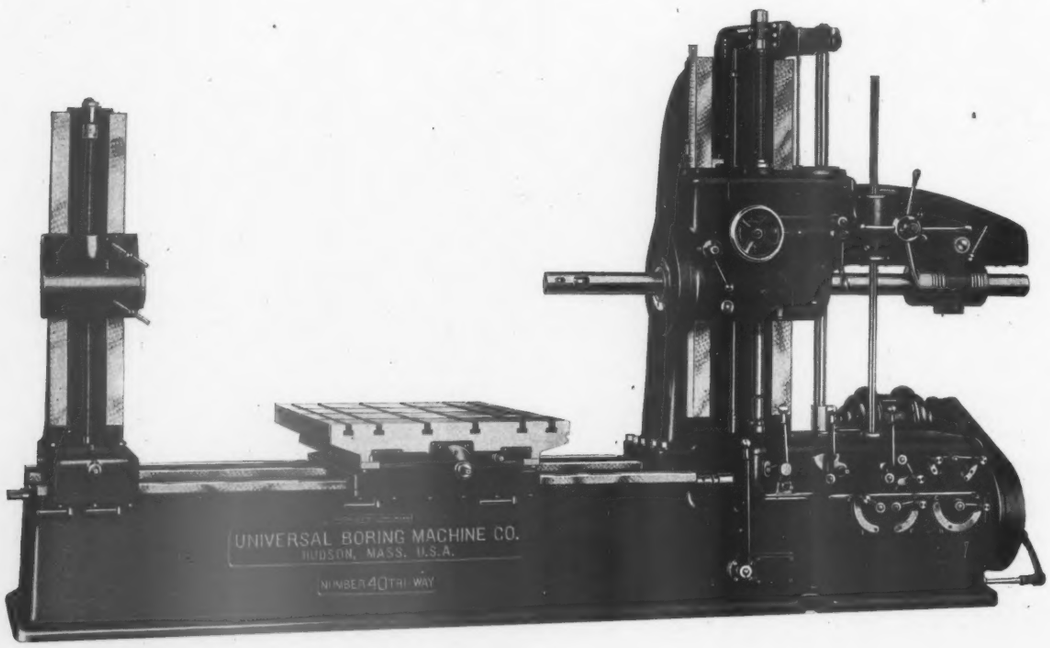
BETTS - NEWTON - COLBURN - MODERN - HILLES & JONES

CONSOLIDATED

CONSOLIDATED MACHINE TOOL CORPORATION *of* AMERICA, Rochester, N. Y.

UNIVERSAL (HORIZONTAL) BORING MACHINE

TRI-WAY TYPE



A "Universal" will earn its cost in two years — or less . . .

If you are planning to add new or replace old equipment, weigh carefully the advantages of a "Universal."

More than 100 different railroad shop jobs which ordinarily require the use of two or more machine tools to finish, can be handled *completely* on a "Universal."

Boring, drilling and milling operations can be done with *one set-up* on such parts as air pump cylinders, driving boxes, steam pipes, throttle boxes, crossheads, superheater headers and reverse gear cylinders. Time and labor is saved, perfect alignment and absolute accuracy assured.

Fast, accurate, adapted to a wide variety of work, Universal (Horizontal) Boring Machines often pay for themselves in 2 years, some save their cost every year when in constant use. Write for complete information.

Universal Boring Machine Co.

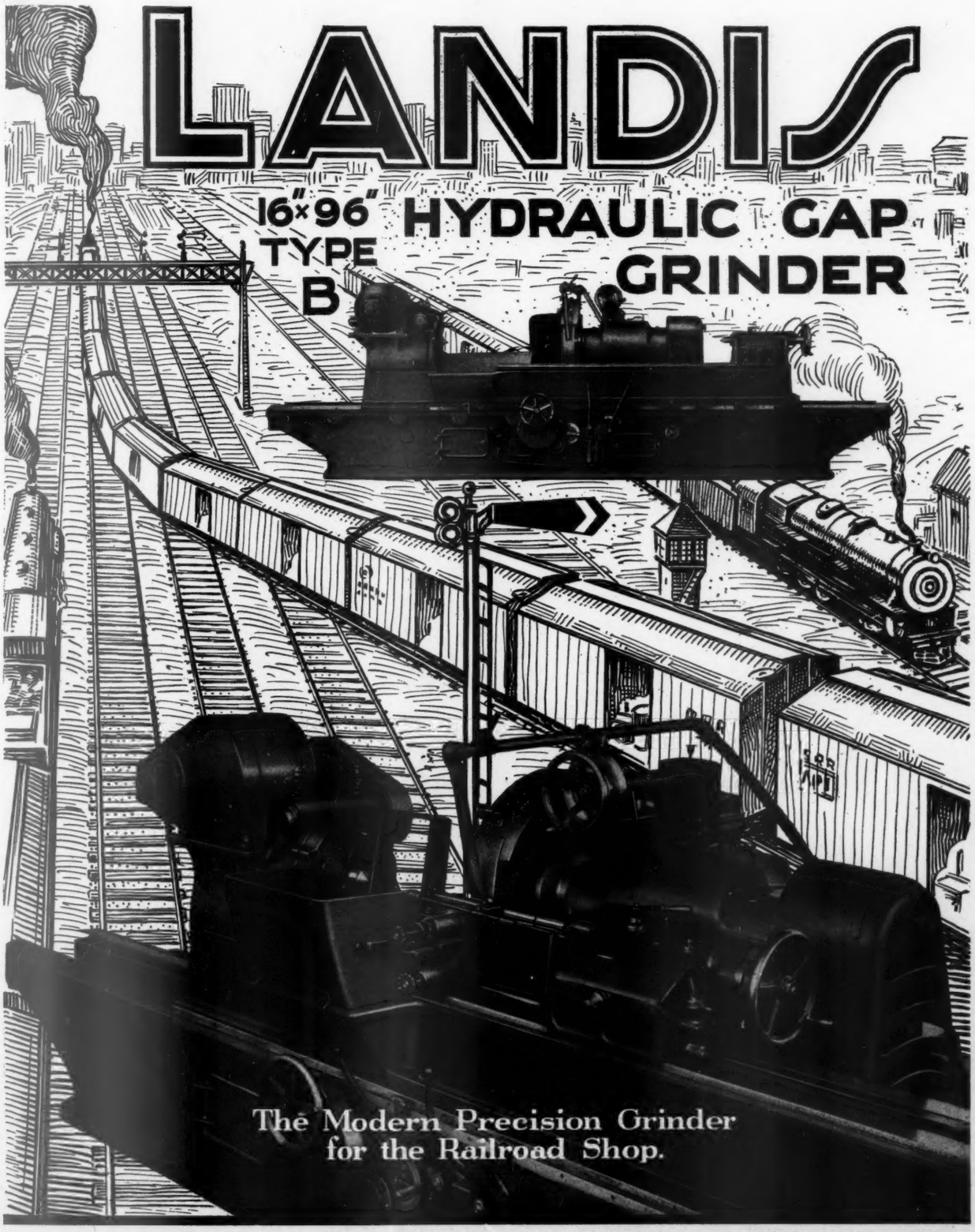
HUDSON, MASS., U.S.A.

"WHERE ACCURACY COUNTS, WE WIN"

4536

LANDIS

16"×96" TYPE B HYDRAULIC GAP GRINDER



The Modern Precision Grinder for the Railroad Shop.

LANDIS TOOL COMPANY

WAYNESBORO, PA.

55

DETROIT CHICAGO NEWARK PHILADELPHIA

Saves Money

On Every Job

PRACTICALLY every job handled on a steam hammer can be produced for less cost on a "UNITED" High Speed Steam Hydraulic Press.

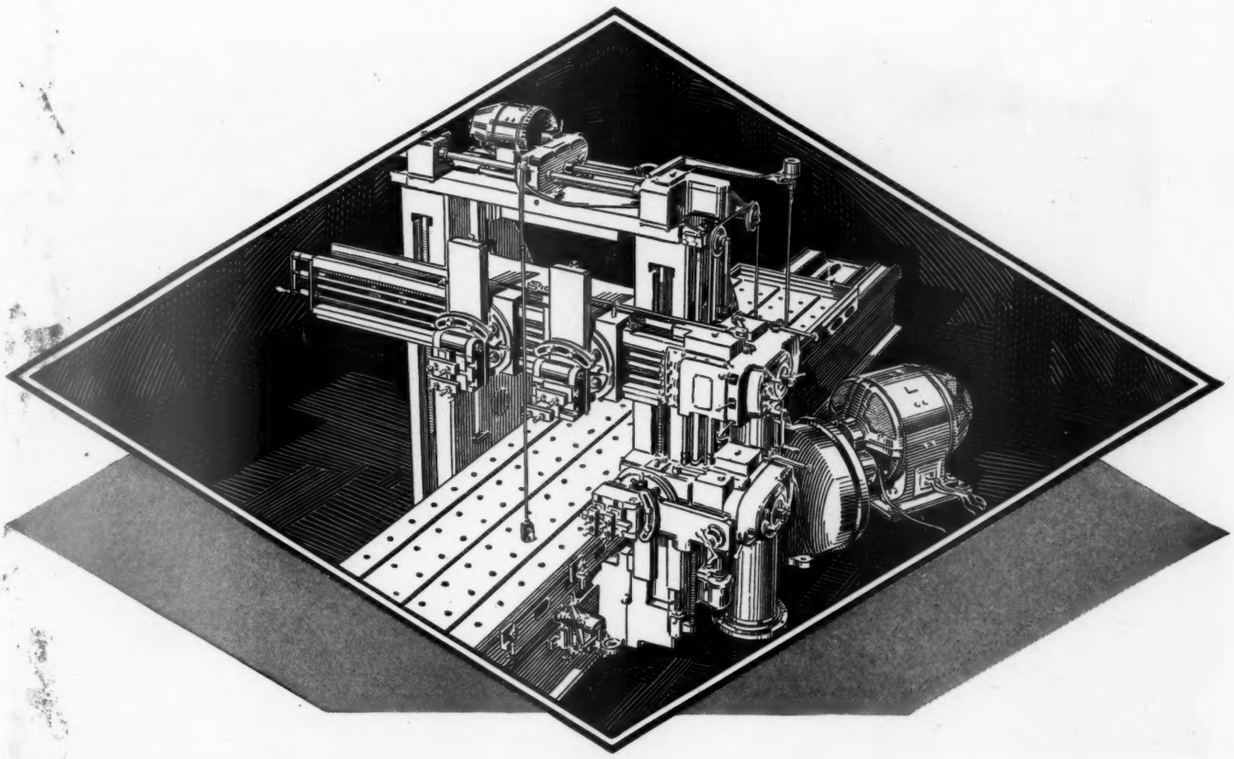
The silent, powerful and rapid action of a "UNITED" Press saves time, labor and fuel on welding, straightening, pressing and shearing operations as well as on all forging jobs.

Another feature of especial interest to shop executives is the fact that parts can be forged much closer to finished sizes on a "UNITED" Press than on a steam hammer. This means a big saving in the machine shop.

No railroad shop unit pays a bigger return on the investment.

Modernize your forge shops with a
UNITED PRESS
PATENTED
United Engineering & Foundry Co.
Pittsburgh, Pa.

UNITED FORGING PRESSES
HIGH SPEED STEAM HYDRAULIC



BORN *of* GIANTS

The Sellers Spiral Gear Drive Planer is one of a large family of production tools including such machines as Floor Boring Machines, enormous Boring Mills, Railroad Driving Wheel and Car Wheel Lathes, Locomotive Driving Box Borers and others.

To constantly improve the entire Sellers line of tools—to design not only for present production needs, but to anticipate future requirements—is the problem of a group of engineers occupying a unique position in the machine tool industry.

The Sellers Planer, sharing with the larger tools this unusual engineering background, reflects the same sound fundamental principles of design—embodies all the advanced ideas for improved efficiency, increased production capacity, economy of operation.

It represents a degree of machine tool perfection that only such an organization could produce.

WILLIAM SELLERS & CO., INC., Philadelphia
Established 1848

SELLERS
MACHINE
TOOLS

Sellers Industrial Tools comprise Drill Grinders, Tool Grinders, Spiral Gear Drive Planers, Boring and Turning Mills, Floor Boring Machines, Planer Type Milling Machines, etc. Sellers Railroad Tools comprise Car Wheel Lathes, Driving Wheel Lathes, Car Wheel Borers, Driving Box Borers. Also manufacturers of Sellers Locomotive Injectors.

The Highest Lathe Speed Ever Attained!

THE NEW Monarch SUPER High-Speed Lathe . . . with spindle speeds up to 4400 R. P. M. . . . marks a new epoch in lathe practice. It makes the use of tungsten-carbide turning tools both practical and economical.

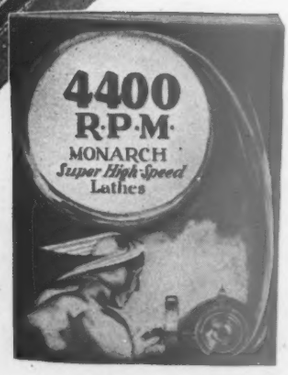
Speed, economy and high production records, which a few months ago seemed impossible, are now every-day occurrences. A glance through record sheets of this lathe's performance . . . in comparison with those of an ordinary high-grade lathe using high-speed steel turning tools . . . reveals facts like these:

Ordinary lathe time, per piece, 8.9 min.
Monarch Super High Speed time 0.7 min.

Ordinary lathe time, per piece, 19.1 min.
Monarch Super High-Speed time 2.0 min.

Ordinary lathe time, per piece, 3.0 min.
Monarch Super High-Speed time 0.5 min.

The combination of a perfectly Timkenized spindle and an anti-friction tailstock center that will stand up to terrific speeds—together with extreme rigidity and weight—make these records possible.



Bulletin 146 gives you FACTS, FIGURES, PROOF! Write today for your copy.

THE MONARCH MACHINE TOOL CO., Sidney, Ohio, U.S.A.

New York Sales Office, 857 Graybar Building

Monarch Lathes

Helical Gears - Timken Bearings

SMOOTHER . . QUIETER . . MORE POWERFUL

Unleashing the Modern Machine Tool

COMOKUT

The very rapid development of machine tools in recent years led to a condition where the tool steels available could not bring out the full possible productive capacity of the machines.

Anticipating this situation, Bethlehem Tool Steel Metallurgists devoted an enormous amount of time and effort to the development of a tool steel capable of putting to work this hitherto unused potential productive capacity of modern machine tools.

Comokut, the result of this extensive research, is a new high-speed steel of superlative cutting ability. It frees the modern machine tool from the limitations imposed by tool steel that cannot stand the feeds, speeds, and depths of cut essential to maximum output. It enables it to work right up to its full capacity.

Either the composition of this steel, with its content of Cobalt, Tungsten, and Molybdenum, or its manufacture in high-frequency electric induction melting furnaces, would alone make Comokut an outstanding cutting steel. The combination of these two factors results in a high-speed steel that establishes an entirely new standard of tool steel performance.

BETHLEHEM STEEL COMPANY
General Offices: Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Buffalo, Pittsburgh, Cleveland, Cincinnati, Detroit, Chicago, St. Louis
Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Seattle, Portland, Honolulu
Export Distributor: Bethlehem Steel Export Corporation, 25 Broadway, New York City

BETHLEHEM

A COMMON CASE
OF BATTERY AND ASSAULT

Injuries Sustained are:

Ends Cracked and Upset

Lubricating Holes Closed

Lathe Centers Spoiled

Threads Closed

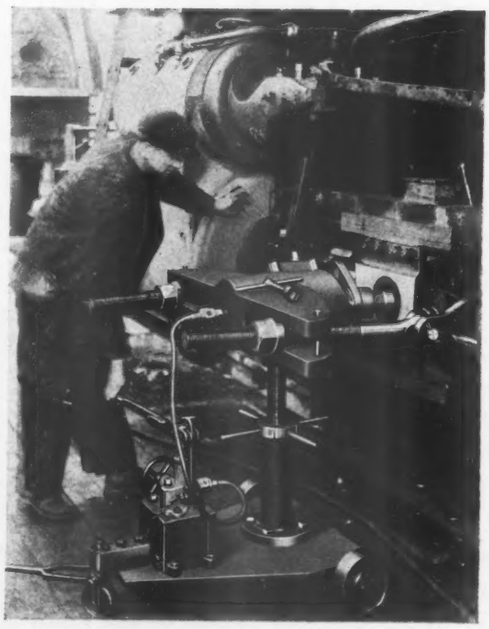
"NOT GUILTY OF SUCH WORK"
Is the Verdict handed down on the

SHAFFER - WATSON - STILLMAN
CROSS-HEAD PIN EJECTER

These Cross-Head Pin Ejectors will force out Pins with a minimum of labor without deforming or injuring them in any way.

Just roll the machine to the job, adjust the hooks and with a few strokes of the pump handle the pin is out.

Write for Bulletin C-33 for more information



THE WATSON-STILLMAN CO.

116 Washington Street, New York

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705 Olive St., St. Louis
Union Trust Bldg., Pittsburgh
321 Brown Marx Bldg., Birmingham
First Nat'l Bank Bldg., Cincinnati
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518 4th Ave., Seattle
224 Pine St., Portland, Ore.
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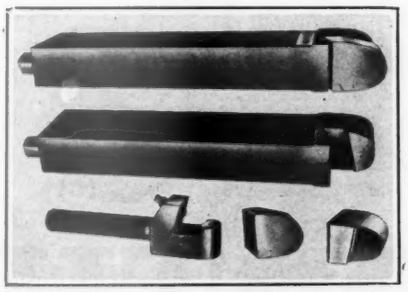
40 pairs of Wheels

Between Grinding Periods



Wheel Lathe Set

OK Tool Bits are doing this daily for railroad shops and can do the same for you.

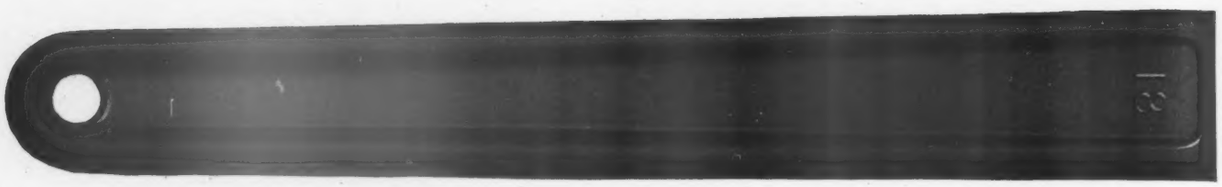
Continuous operation of the lathe assured because only the bit has to be changed which is done by loosening a single screw at the rear of the holder and a new "O K" Bit inserted.

Our "Service Department" will be glad to demonstrate their practicability at your request.

O.K. Tools for LATHES, SHAPERS, PLANERS, BORING MILLS, AUTOMATICS, SPECIAL MACHINES, MILLING MACHINES

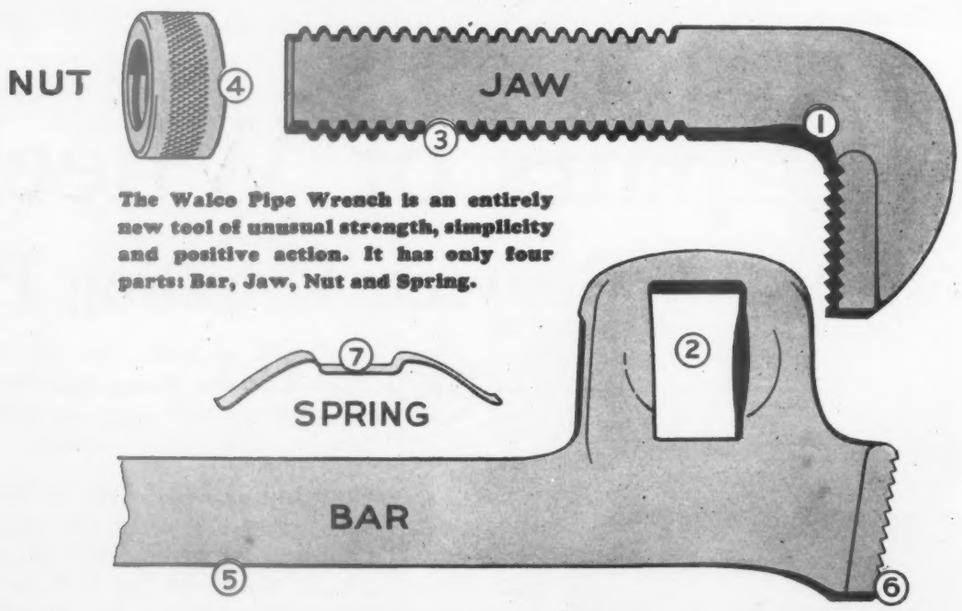
THE TRADE O K MARK TOOL CO., INC.
SHELTON, CONN.
Sole British Representative -
Richard Lloyd & Company, Ltd., Birmingham, England

WALCO



The New Pipe Wrench

MADE BY WALWORTH (PATENTED)

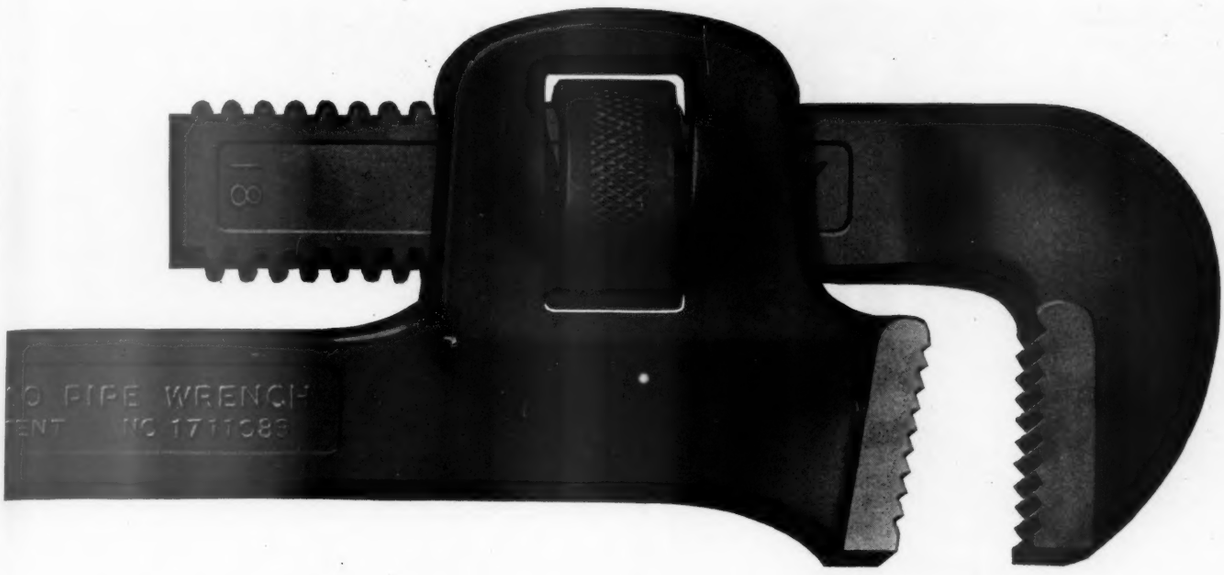


The Walco Pipe Wrench is an entirely new tool of unusual strength, simplicity and positive action. It has only four parts: Bar, Jaw, Nut and Spring.

WALWORTH

Walworth Company, General Sales Offices: 60 East 42nd St., New York
Plants at Boston, Mass.; Kewanee, Ill.; Greensburg, Pa.; and Attalla, Ala.
Walworth Company Limited, 660 St. Catherine Street West, Montreal, P. Q.
Walworth International Co., 11 Broadway, New York, Foreign Representative
. . . Distributors in Principal Cities of the World . . .

All parts accurately heat treated for



A HUSKY WRENCH FOR HUSKY MEN

1 **JAW—Drop-forged high grade tool steel; scientifically designed to provide maximum strength by proper distribution of metal.**

2 **JAW HOUSING—One piece with bar, drop-forged from high grade tool steel; protects nut against damage and loss of adjustment.**

3 **JAW THREADS—Notice the rounded crests of the threads, designed to resist damage in use and to avoid jamming inside the nut.**

4 **NUT—The new design of the nut provides a raised surface on each side of the knurl to protect it from battering.**

5 **BAR—Drop-forged from high grade tool steel, with metal distributed to provide maximum strength, comfortable handgrip.**

6 **TEETH—New design to insure quick, certain grip. Scientific heat treatment imparts correct combination of hardness and strength.**

7 **SPRING—Entirely new alloy steel spring provides double action on jaw. Easily replaced without tools.**

greatest possible endurance and strength

...they helped to build a highway...

thru the *Clouds*

ATOP of each lofty tower . . . so high that the mighty Hudson becomes a silver ribbon and the Palisades sink into the level of the surrounding landscapes . . . two 100-ton Shaw Cranes place the strands that form the cables for the Hudson River Bridge.

It is significant that Shaw Cranes were selected by Roebling Engineers for so important a task. Absolute precision and unquestionable dependability are paramount for the slightest failure might very well mean loss of life, time and money.

An interesting side light is that these Cranes are used not only for the original purpose, but act as general hoists as well. They save the builders thousands upon thousands of dollars in additional equipment. We are justly proud of this installation and the work it is doing.

Manufactured at
SHAW CRANE WORKS, Muskegon, Mich.

Owned by
MANNING, MAXWELL & MOORE, Inc.
General Offices: 100 E. 42nd St., New York City
Branches: Chicago Detroit Philadelphia Pittsburgh St. Louis

Representatives:
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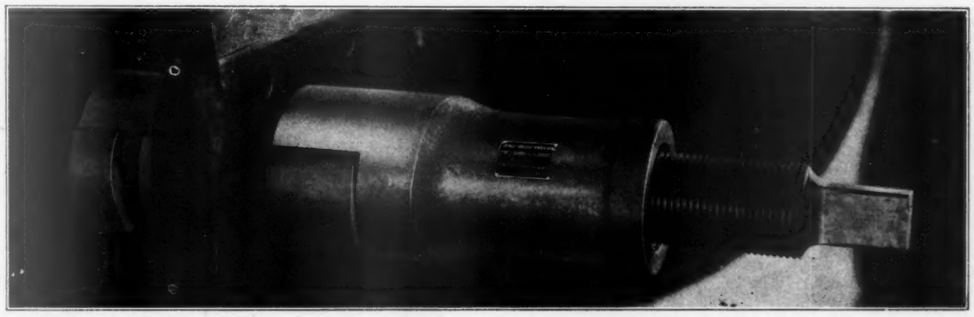
401 Third Ave., Los Angeles, Cal.
BUCKNER-WOODARD CO.
1743 First Ave., Seattle, Wash.

SHAW
ELECTRIC TRAVELING CRANES

MANNING, MAXWELL & MOORE, Inc.

WHAT THE M.M. AND S.M.P. THINK OF THE SMITH PISTON PARTER

THE Smith Piston Parter is one of those valuable "MUST HAVE" tools because experience shows that it costs much more not to have one than to have one on hand in all shops and roundhouses.

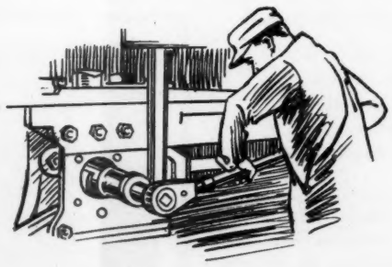


Almost every big American road saves time, men, material, money with Smith Piston Parters. Don't take our word for it, read what some of the Master Mechanics and Superintendents of Motive Power think of the Smith Piston Parter. One writes: "This is to advise that we are getting very good service from the Smith Piston Parter both at our——and—— shops and consider them a great advantage over our old method of extracting pistons."

Another writes: "The Smith Piston Parter in service at——— shops is still giving excellent results."

Still another writes: "The Smith Multiplex Pressure Jack for parting pistons which we have in practically all of our large roundhouses has proven very satisfactory and up to the present writing we have not found one piston that we were unable to extract from crosshead."

In all our experience, we have not found a rod too tight to part with the right size Smith Piston Parter properly set up. The whole job ordinarily takes only one man and from three to seven minutes. The very difficult jobs may require two men and seldom over fifteen minutes.

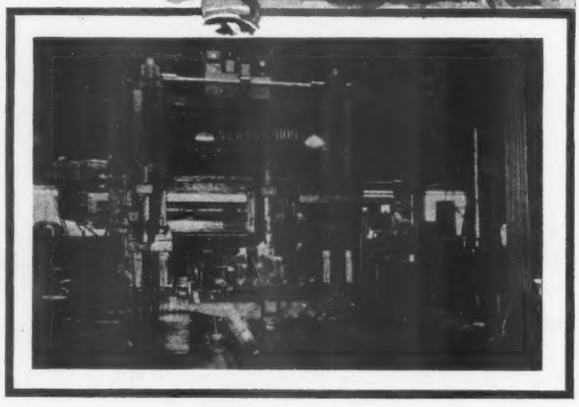


We welcome the opportunity to answer any questions — and to arrange for a demonstration where possible.

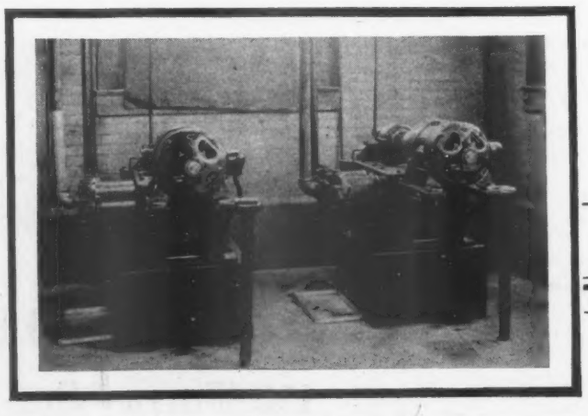
The Clark Manufacturing Co.

110 Turner St., Philadelphia, Pa.

Worthington compressor driven by a Westinghouse 60-hp. 300-rpm. Synchronous Motor in a railroad shop.



Westinghouse-equipped Newton planer type milling machine used for milling locomotive frame castings.



Two National Brake and Electric Company air compressors driven by Westinghouse 7½-hp. Type CS Motors. Installed in a railroad signal tower.

DRIVE!

THAT innate ability to keep going at top speed in the face of tough opposition . . . stamina to carry on through the tight spots . . . the will to do! . . . punch! . . . drive!—that's the stuff that makes winning football teams.

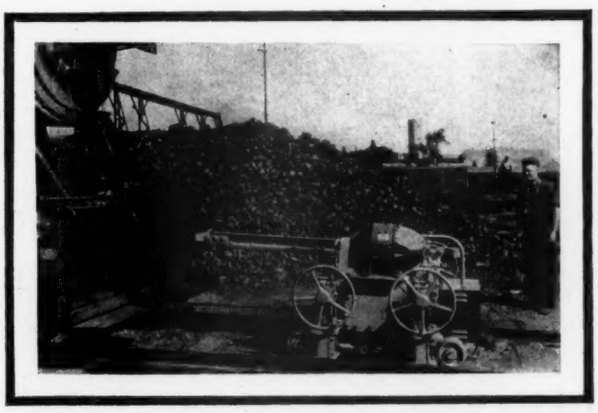
Likewise, the ability to keep going at top speed . . . reserve power for peak loads . . . punch! . . . drive! . . . dependability—these are the qualities that have made Westinghouse motor drives the preferred choice of industry.

Such features as dual-protected windings . . . directed ventilation . . . no hidden hot spots . . . sealed-sleeve bearings . . . and control units—matched to the motors . . . are winning for Westinghouse motor drives a growing preference among experienced buyers.

For every power application, Westinghouse is equipped to supply the right motor . . . the right control . . . and (if the application requires) gear units or cog-belt drives in the right combination.

Westinghouse engineers will be pleased to work with you in the application of Westinghouse motor drives in your plant.

Automatic electric 2-hoist, 2-track coaling and sanding plant. The two elevator hoists are driven by two Westinghouse 25-hp. Type CI Motors.



Whiting locomotive spotter equipped with a Westinghouse totally enclosed 5-hp. SK Motor. Normal height of rack bar is same as A. R. A. specifications, but a spring tension arrangement provides for variance in height of coupling blocks.

Service, prompt and efficient, by a coast-to-coast chain of well-equipped shops

Westinghouse

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TUNE IN THE WESTINGHOUSE SALUTE OVER THE N. B. C. NATION-WIDE NETWORK EVERY TUESDAY EVENING.

Lower Maintenance Costs with I-R Drills

Ingersoll-Rand long-stroke drills, with single-piece, drop-forged connecting rods, heavy crank, helical gears, and simple, balanced valve, stay on the job longer with maximum drilling, reaming, and tapping power.

No other piston drills are equipped with the automatic governor which eliminates free speed racing, saves taps and reamers, and saves the machine.

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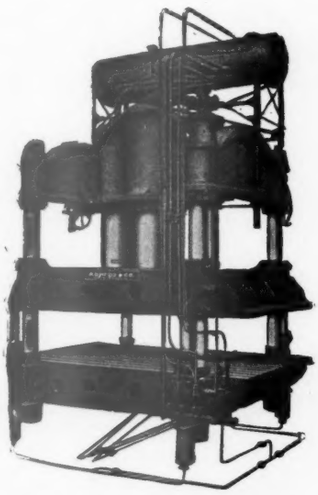
HYDRAULIC TOOLS AND MACHINERY

FOR RAILROAD, LOCOMOTIVE AND CAR SHOPS



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We build a complete line of up-to-date hydraulic tools designed for efficiency and economy in operation.

Our standard hydraulic tools are manufactured in all sizes and types, and comprise:

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Sectional Flanging Presses
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Bushing Presses
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Bending Presses
Forging Presses
Punches
Shears
Spring Machinery
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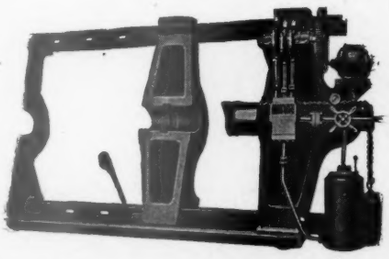
Pumps

HYDRAULIC RIVETER



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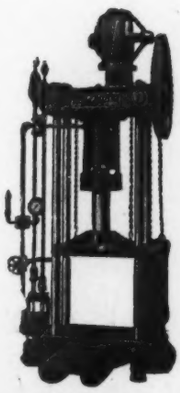
Our experience, extending over a long period of years, together with our excellent shop facilities also enable us to design and build hydraulic machinery to meet any special requirements.

Our illustrated catalogues "Hydraulic Machinery" and "Hydraulic Valves & Fittings" mailed upon request.



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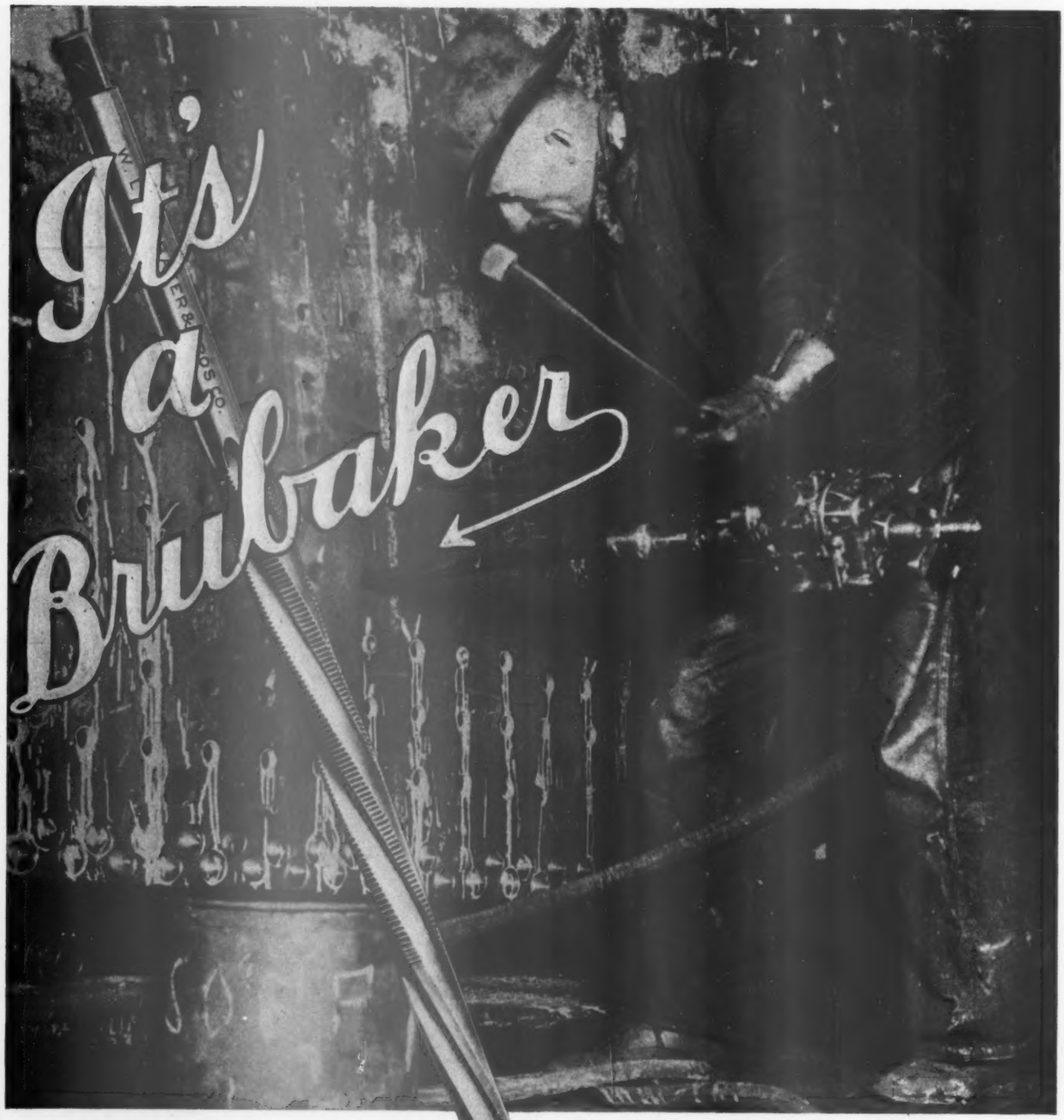
CAST IRON PIPE, HYDRANTS AND VALVES



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THE Brubaker Spiral Fluted Staybolt Tap cuts faster and easier because of its patented special relieved spiral fluted design. Continuous engagement of the cutting edge —more contact points and greatly reduced friction increases tapping speed and insures clean cut, perfect threads that put your boiler work on a higher plane of dependability and efficiency.

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BRUBAKER Taps hold their edge for long periods and breakage is negligible. Longer life is due in part to the unique design, which makes cutting easier. But design is not all, Brubaker Taps embody the finest materials, exacting workmanship, rigid inspections and scientifically controlled tempering all of which combined make Brubaker Taps a superior product.

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50 CHURCH ST. N.Y.

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TAPS-DIES-REAMERS

FACTORY
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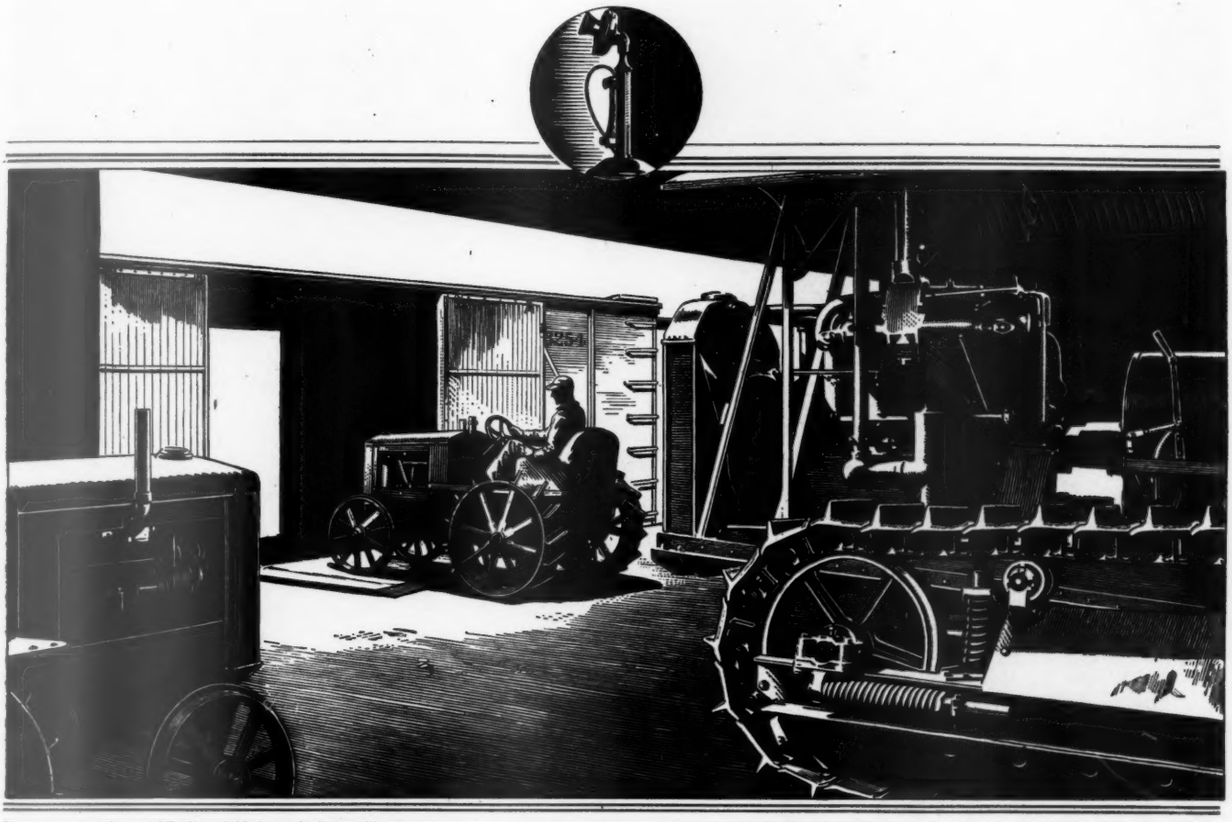

Business was Quiet... but the Telephone brought $22,200 in New Orders

A TRACTOR company's sales had fallen off to a marked degree. A telephone sales program to distant customers was decided upon. One result was $18,400 worth of business. Another, a $3800 order after the purchaser had refused a personal interview.

An Eastern lumber company regularly "visits" lumber yards in five states by telephone. In one month 550 carloads of lumber totaling nearly $500,000 were sold by this modern method. Toll bills averaged less than one-half of one per cent.

Business firms, large and small, are using out-of-town telephone service more than ever to increase sales . . . reduce distribution costs . . . meet competition. New markets are developed at little expense. Customers and prospects are economically contacted between salesmen's visits.

Develop your business by telephone. Best results are obtained by having a definite plan for executives and salesmen to follow. Your local Bell Telephone Business Office will gladly submit a plan to meet your needs.

Inter-city calls are cheap, definite, resultful. Typical station-to-station day rates: Pittsburgh to Indianapolis, $1.50. Boston to Atlanta, $3.50. New York to Baltimore, 90c. Philadelphia to Seattle, $8.50. Bell Telephone service is *Quick . . . Convenient . . . Universal.*

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AMERICAN TELEPHONE & TELEGRAPH CO. AND ASSOCIATED COMPANIES

ROTARY AIR GRINDERS

A Tool That Gives Universal Satisfaction
Made in Two Sizes Nos. 16 and 18

CLECO NO. 16 GRINDER ON STEEL CASTING

CLECO NO. 18

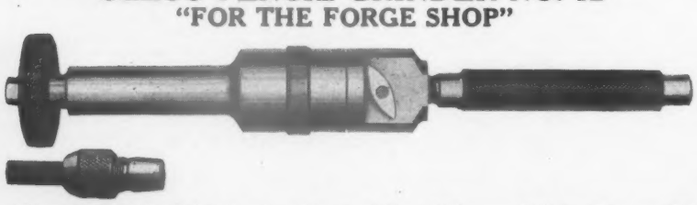
Cleco Grinders have a single rotor which is concentric with the arbor insuring a perfect balance at all speeds.

The "Governor" maintains the correct speed for the type of emery wheel used with ample power for each size wheel.

Cleco Grinders are provided with an "Oil Reservoir" located in the cylinder body which holds a full days supply of oil which is automatically fed directly to the "Rotor." This patented oil controlling device eliminates all lubrication troubles as the oil passes through large ports insuring a steady flow of lubricant.

Size No.	Wgt. lbs.	R.P.M.	TABLE OF SIZES AND CAPACITIES WITH ELASTIC BONDED WHEELS—WITH VITRIFIED WHEELS	CODE
16	14	5600	Elastic Bond—6" x 1¼" x ⅝"—Vitrified, 4" x 1¼" x ⅝" Wheels	Panic
18	15	4300	Elastic Bond—8" x 1¼" x ⅝"—Vitrified, 6" x 1¼" x ⅝" Wheels	Pansy

CLECO PENCIL GRINDER NO. 12
"FOR THE FORGE SHOP"



The Cleco Pencil Grinder is adapted for "die work" in Forge Shops and for touching up worn and rough spots in die-blocks without removing them from the drop hammer. The Cleco is also adapted for any light grinding with Emery Wheel or Emery Stick such as finishing raised metal letters, and for floral designs in ornamental iron work.

—SPECIFICATIONS—

The CLECO No. 12 Pencil Grinder weighs 1½ pounds. The length without extension handle, 9-inch. Diameter of Grinder body 1⅞-inch—speed, 14,000 r.p.m.
Fitted with arbor for 2¼" x ¼" x ⅜" emery wheels and chuck for ½-inch emery stick—Code—PANT.

We Manufacture Bowes Couplings and Air Valves

CUT SHOWS OPERATOR FINISHING STEEL DIE

LATEST CATALOG MAILED ON REQUEST

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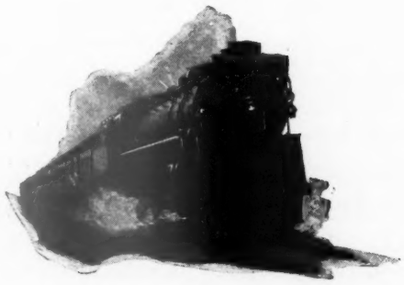
THE CLEVELAND PNEUMATIC TOOL CO.
CLEVELAND, OHIO **U. S. A.**

BRITISH ISLES—JOHN MACDONALD & CO. (Pneumatic Tools) LTD., GLASGOW, SCOTLAND.

Cutting off staybolts with an oxy-acetylene cutting blowpipe.

CUTTING TIME AND COSTS



AN important part of Oxweld Railroad Service is the supervision of oxy-acetylene cutting operations on railroads throughout the country. In this department alone it has effected sweeping economies in time and expense. Operations that formerly required several men over a period of days or weeks, can now be accomplished in a few hours by a single cutting blowpipe operator trained by Oxweld.

Oxweld Railroad Service supplies an essential in railroad maintenance—efficiency in the application of the oxy-acetylene welding and cutting process. Oxweld efficiency is one reason why a majority of the Class I railroads in the country contract for Oxweld Railroad Service year after year.

OXWELD RAILROAD SERVICE

THE OXWELD RAILROAD SERVICE COMPANY

Unit of Union Carbide and Carbon Corporation

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FIGURE 106-A

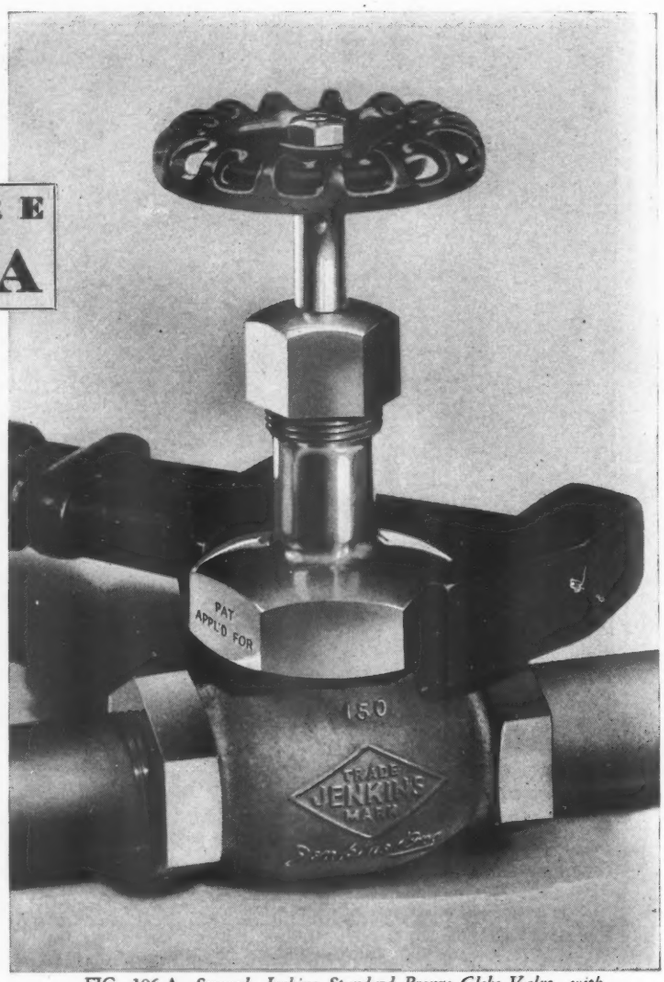

FIG. 106-A, *Screwed, Jenkins Standard Bronze Globe Valve, with one-piece screw-over bonnet and slip-on stay-on disc holder. For 150 lbs. steam working pressure, or 250 lbs. oil, water, gas working pressure.*

This one-piece screw-over bonnet won't distort . . .

Here is a valve that doesn't "fear" a wrench. It is a Fig. 106-A Jenkins Standard Bronze Globe with the one-piece screw-over bonnet.

This bonnet construction provides unusual strength to resist the strains of frequent removal. You can take the bonnet off and replace it repeatedly, and it won't distort. The large hex faces enable you to get a full purchase with a wrench.

Another advantage of Fig. 106-A is the slip-on stay-on disc holder . . . . a real innovation, possible only in this screw-over bonnet design. Ask your supply man to show you this Jenkins. Its superiority of construction and finish can be seen at a glance. It is made also in angle, cross and check types, screwed or flanged. Write for Bulletin 141 containing details.

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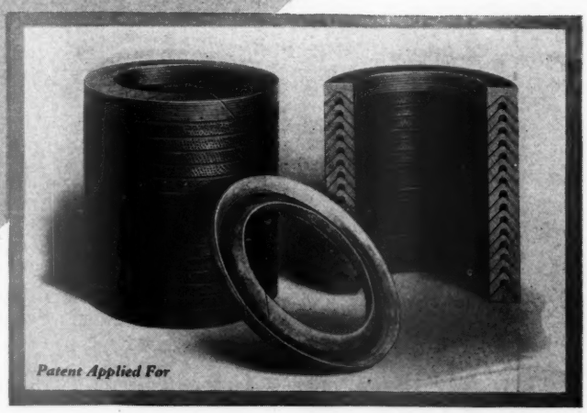
Jenkins
VALVES
Since 1864

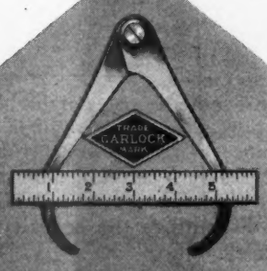
JENKINS VALVES ARE ALWAYS MARKED WITH THE "DIAMOND"

GARLOCK-430 Chevron Packing



The greater the pressure the tighter it packs!

GARLOCK—430 Chevron Packing is an automatic packing designed and recommended for service on the rams and plungers of accumulators, presses, pumps and other heavy duty hydraulic equipment. (For high temperatures specify Garlock 530.)



THE GARLOCK PACKING COMPANY, PALMYRA, N. Y.

A World Wide Organization with Sales Offices and Warehouses in all Principal Industrial Centers

14 leaders cooperated *in preparing this book* for you

Presents facts and figures on fastening methods which have proved particularly advantageous.

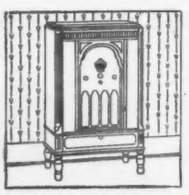
TO help you attain greater fastening economy this interesting and informative booklet has just been published. It was prepared with the cooperation of fourteen of the most prominent manufacturers in their respective fields, who permitted a nationally known firm of engineers to enter their plants and make studies of fastening methods which have proved particularly advantageous.

Certified facts and figures from those studies make up the booklet. Every production executive who is interested in attaining faster, easier, more economical assembly of a product made wholly or partly of metal should read with great interest such accounts as:

Servel saves $64,120 a year . . .

by assembling the exterior metal sheathing of their refrigerator cabinets with Hardened Self-tapping Sheet Metal Screws. This story of fastening economy is told by one of Servel's engineers, who describes the former methods of making the assembly, as well as the present method which eliminates a skeleton frame-work of wood with a saving of $1.00 per cabinet.

44 tapping operations eliminated on Philco Radio



by fastening parts to the chassis with Hardened Self-tapping Sheet Metal Screws. The details of this achievement are particularly interesting since few products require more assembly work than a radio receiver. This report also explains the severe tests by which Philco determines the security of a fastening.

50% saving made by Doehler . . .

through the use of Self-tapping Screws on both vending machine and metal furniture assemblies. In this fastening study, the Chief Engineer of Doehler Die Casting Co. discusses alternative methods of fastening to die castings and of assembling sheet metal.

Enormous savings effected in auto production . . .

where fastening devices are selected with utmost care. That such effort pays, is proved by an account of the way a great builder of auto bodies saved $150,000 in a year by using Self-tapping Sheet Metal Screws for making fastenings to sheet metal.

Every study is worth reading!

All of the fastening studies in this book are interesting. Other contributors include: Zenith-Detroit, Gilbert and Barker, Stout, Edison and Simmons.

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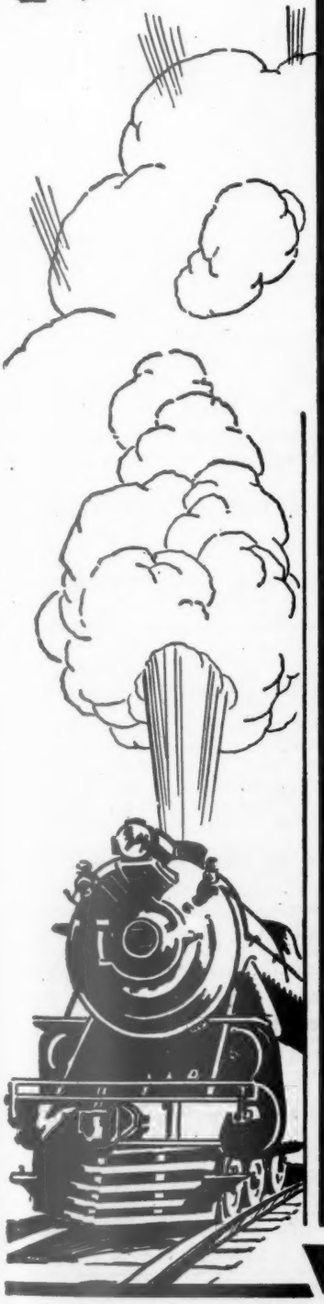

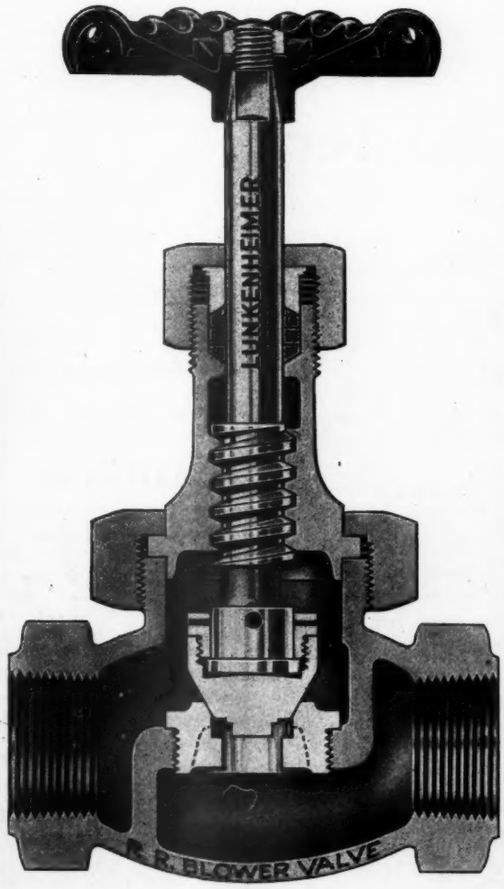

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"R. R. BLOWER" VALVES
300 lb. W. S. P.
EXTRA HEAVY

are particularly adapted where frequent operation under wire drawing conditions subjects the valve to extremely severe service.

Exceptionally rugged stem threads which permit fast operation and fine regulation, guard against the rapid wear and stripping of threads resulting from frequent operation.

Both the Inside Screw and Outside Screw and Yoke patterns have monel seat and disc of throttling design which retards wire drawing and prolongs seat tightness.

Seating surfaces are regrindable and all parts are renewable.

Write for the Lunkenheimer "R. R. Blower" Valve Folder, F. 514. G. E.

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Send literature on a.c.f. Berwick Electric Rivet Heaters. We heat about ..... rivets daily.

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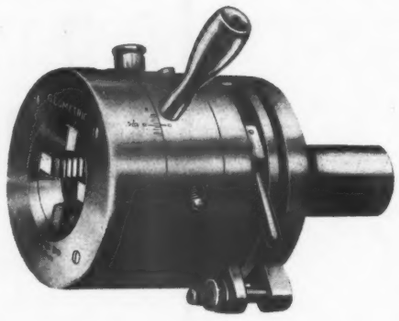
STRONG, STURDY TOOLS
FOR RAILROAD SHOPS



The Tool pictured above is but one of the many Geometric Tools used extensively in Railroad Shops where coarse pitches demand strong, sturdy tools backed by walls of heavy metal. Geometric builds:—

Self Opening Die Heads
Taper Cutting Die Heads
Collapsing Taps
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For Cutting
Soft Metals, Pipe, Wire Cable, Tubing, BX Electric Conduit, BX Cable and Conduit, without Breakage or Stripping of Teeth.
One Half Gross
Tungsten Steel
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"We keep a store room stock of Smooth-On No. 3 specially for this work, and see that more is on hand before all the old supply is used up.

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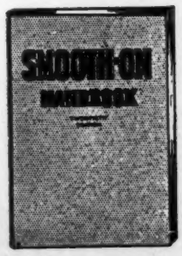
Get Smooth-On No. 3 in 1 or 5-lb. can or 25-lb. steel pails from your nearest dealer or if necessary, direct from us.



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In Canada: **Dominion Chain Company, *Limited*, Niagara Falls, Ontario**

Brake chains; Train chains; Sling chains; Switch chains; Gate chains; Wrecking chains; Crane chains; End door chains; Door Operating chains; Brake Beam chains; Brake Beam Safety chains; etc.

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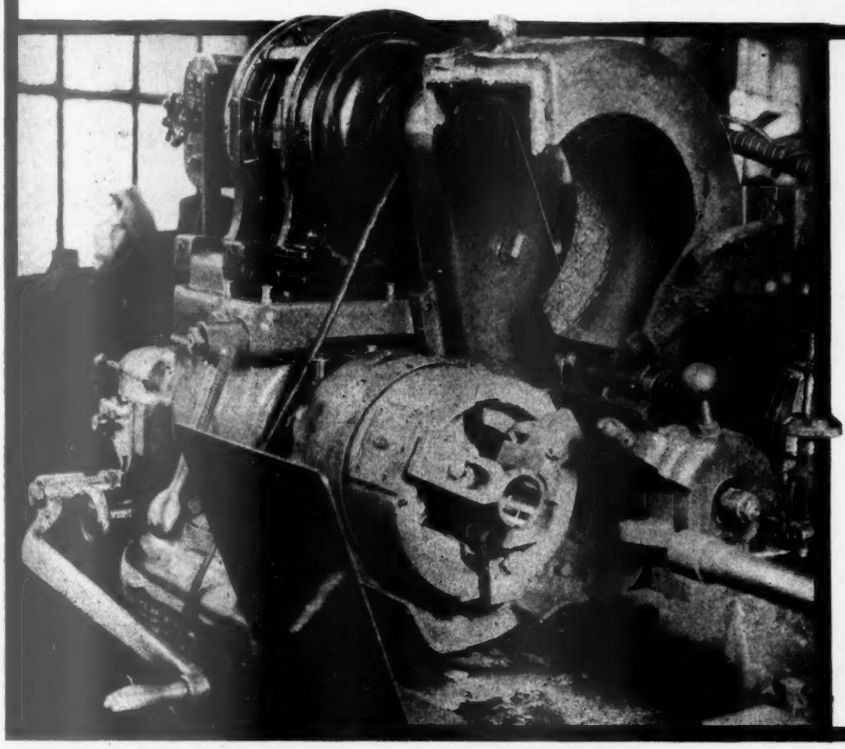
ROOKSBY Portable Tools

ECONOMIZE *in SHOP on ROAD*



HEALD

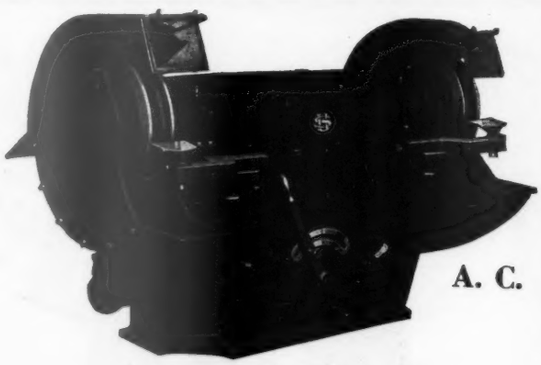
SIZE-MATIC GRINDER

HEALD Size-matic Grinder economies are two-fold. They go far beyond the shop economies where time, labor and materials are saved by fast speeds, fast feeds and accurate finishes which guarantee fits and eliminate spoilage.

Road economies are assured because locomotives go through several shopping periods without bushing repairs or replacements.

Heald ground bushings remain round and true longer—they retard lost motion and insure square valves, better locomotive performance, greater efficiency, lower fuel consumption.

THE HEALD MACHINE CO.
Worcester Mass.



A. C.

(Pat. No. 1,477,052. Other Pats. Pending)

NOW is the logical time to replace obsolete equipment with more profitable, more economical machines. U. S. VARIABLE SPEED GRINDERS, for instance, maintain a constant wheel surface speed clear down to the flanges—even in high speed snagging at 9,000 surface feet per minute! They are the only grinders embodying the patented Gibbs V-Disc Transmission of GRAPHITIZED MICARTA. Ask your jobber for all the facts or write us today.

The UNITED STATES ELECTRICAL TOOL CO.
2487 W. Sixth St. - - Cincinnati, Ohio, U. S. A.

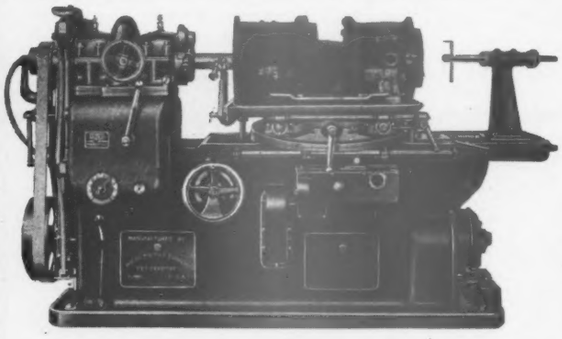
Export Sales Representatives—
WESTINGHOUSE ELECTRIC INTERNATIONAL CO., 150 Broadway, New York City
Canadian Division—MAPLE LEAF ELECTRIC TOOLS Ltd.—Toronto

Now you will have to see the Purchasing Agent!

"All I can do is recommend the machines and I'm recommending Clevelands not only because the Punches and Shears of your make which we installed years ago are still giving us excellent service but also on account of the efficient setup of tools which your engineers specified on that beam type punch—from an engineering standpoint, Cleveland design and construction have my OK."

Punches—Shears—Bending Rolls—Plate Planers, Etc.

THE CLEVELAND PUNCH & SHEAR WORKS CO.
CLEVELAND, OHIO
New York Chicago Detroit Philadelphia Pittsburgh



Lengthen the Time between Air Pump Overhauls!

Without question one of the most versatile machines in the railroad field, the Micro Internal Grinder, Model "FG," is ideally suited for shops of all sizes. The Micro "FG" grinds air pumps in perfect alignment without disassembling. Grinds all internal surfaces—valve motion parts—side rod and main rod eyes with maximum precision, ease and economy. In all instances the Micro grinder definitely lengthens the service life of these parts. Write for illustrated folder.

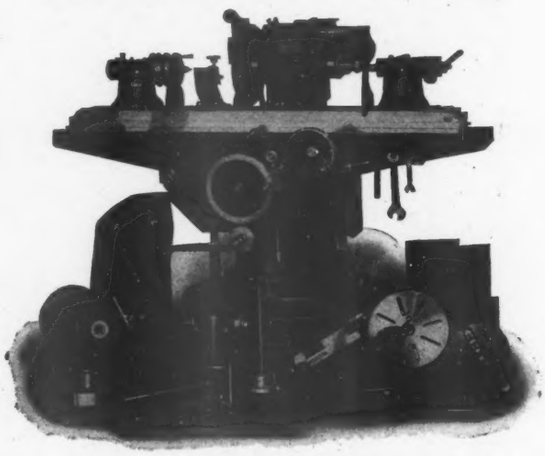
MICRO MACHINE COMPANY

Bettendorf — MANUFACTURERS AND DESIGNERS OF PRECISION GRINDERS FOR ALL PURPOSES — Iowa, U-S-A

THOMPSON

—12" x 36"—

UNIVERSAL GRINDING MACHINES



SEPARATE COUNTERSHAFT DRIVEN

ALSO SELF-CONTAINED, MOTOR DRIVEN

Equipped with fine cross feed for Cylindrical grinding, and independent coarse cross feed for Surface grinding.

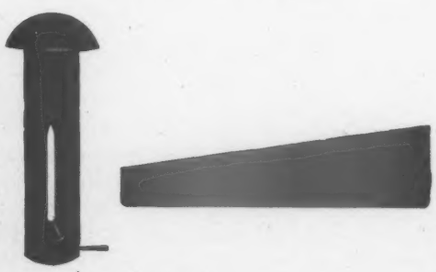
Write for information on Radius Attachment for grinding corners on channelling Cutters.

THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO
1534 West Main Street

REDUCE YOUR BOLTING EXPENSE ONE-HALF BY USING OUR

Special Fitting Up Bolts

ALL SIZES—ANY LENGTH

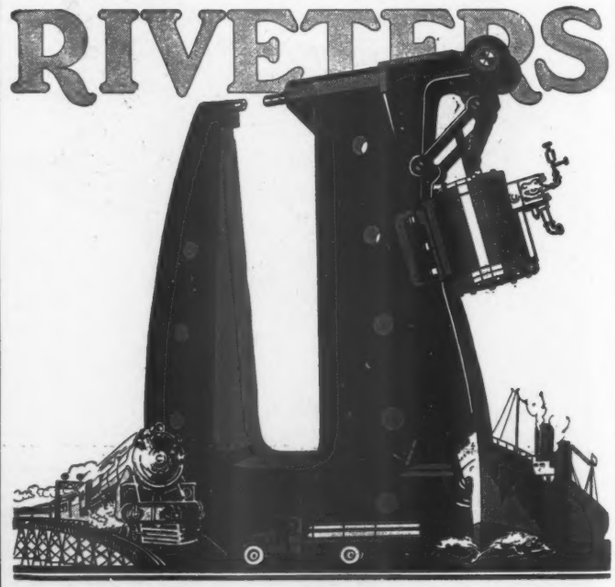


KEY-BOLT APPLIANCE CO.

Manufacturers

Factory and Offices
Elmira, New York
U. S. A.

RIVETERS



THERE IS A HANNA RIVETER TO MEET EVERY CONDITION

HANNA ENGINEERING WORKS
1765 ELSTON AVE., CHICAGO

Hennessy Journal Lubricators

Driving Journal Type

EASY to apply—takes the place of the standard cellar; lateral motion of wheels operates pump which delivers oil of any consistency thus insuring perfect lubrication of journal and hub faces at all times. Prevents hot journals, reduces bearing and journal wear and lowers repair costs. Standard for driving journals of switching locomotives on one of the largest railroads in the United States.

Write for complete information

HENNESSY LUBRICATOR CO.

136 Liberty Street, New York **33 No. La Vergne Ave., Chicago, Ill.**

Mechanical lubricators for all journals of railway equipment.
See previous issues for other journal designs.

HENNESSY LUBRICATOR

Allen

Come to us with your Riveting problems

We are pioneer builders of riveting machines and either have an "Allen" that will do what is wanted or will build one to meet your especial requirements.
For more than 50 years Allen Riveters have set an exceptionally high standard for mechanical excellence and service performance.

Our new Catalog shows full line. Send for it.

JOHN F. ALLEN COMPANY

372 Gerard Ave., New York

"QUICKWORK"

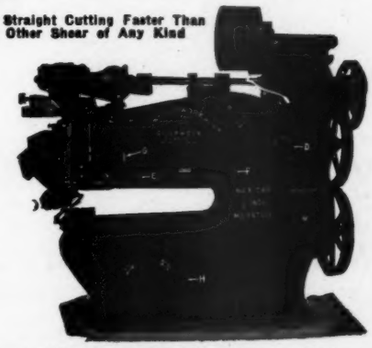
(TRADE-NAME REGISTERED THROUGHOUT THE WORLD)

ROTARY SHEARS

MADE IN VARIOUS SIZES AND STYLES

For cutting all gauges of sheet and plate up to 1 inch thick used in building Ships, Boilers, Cars, Tanks and General Plate and Sheet Metal Work. Cuts square or beveled edges in straight or irregular shapes, also cuts rings and discs, and cuts openings without starting in from side of sheet. Leaves the metal flatter than any other Rotary or Short-Straight-Bladed Shear. Cuts a clean edge that requires no finishing.
Joggling and flanging rolls can be used interchangeably with the cutters.

Do Long Straight Cutting Faster Than Any Other Shear of Any Kind

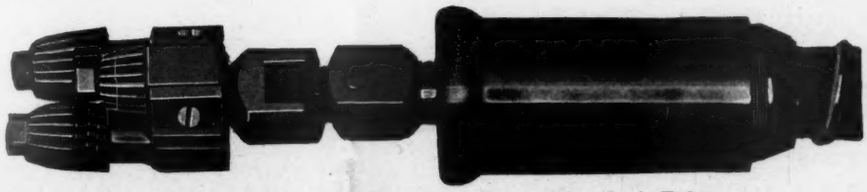


Pat. June 3, 1913; Aug. 26, 1919; Mar. 29, 1921. Other patents pending. One "QUICKWORK" does the work of a number of old style machines. Does it better and from two to ten times quicker.

Eliminate Oxy-acetylene Cutting and Plate Planing
WRITE FOR CATALOG No. 90

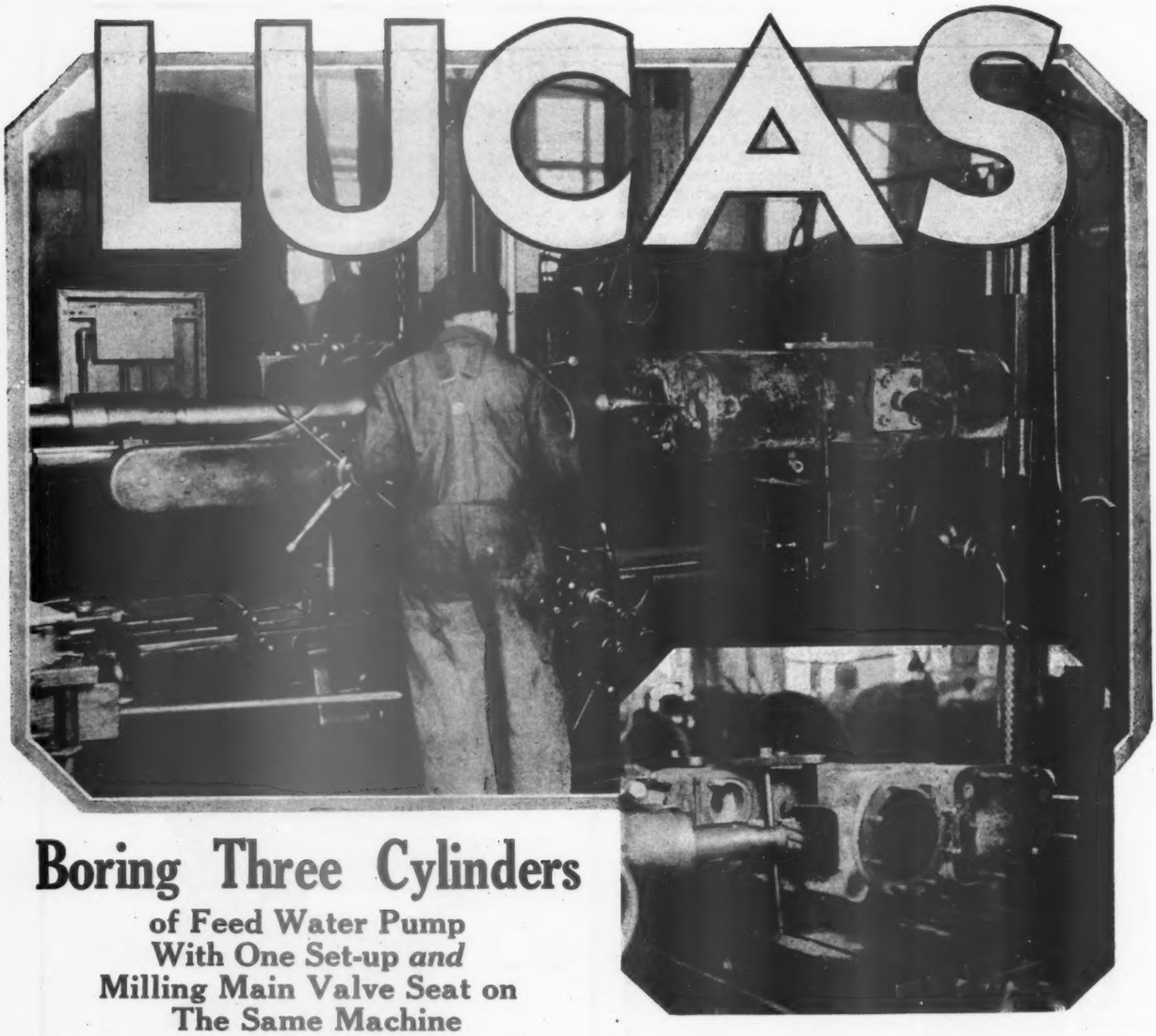
THE QUICKWORK COMPANY
(Not Incorporated—H. Collier Smith, Owner)
St. Mary's, Ohio, U. S. A.
Cable Address: "QUICKWORK." All standard codes used.
New York Exhibit: Grand Central Palace.
Agent for British Isles: Oliver Machinery Co., Manchester, England

ROTO LOCOMOTIVE ARCH TUBE CLEANERS



Roto Air-driven Cleaner for 3" Locomotive Arch Tubes

THE ROTO COMPANY **NEWARK, N. J.**



Boring Three Cylinders

of Feed Water Pump With One Set-up *and* Milling Main Valve Seat on The Same Machine

THIS large feed water pump is set up and machined with the same ease and dispatch as smaller ordinary work.

The first operation (shown in the inset, close-up view) consists of milling the main valve seat and undercutting outer face to raise valve seat 1/16 of an inch.

On the second operation—three cylinders, the hot water cylinder, cold water cylinder and steam cylinder are bored at one set-up.

The Lucas "Precision" Boring, Drilling and Milling Machine, not only saves time and labor on the general run of shop work, but as the machinist put it "Do not know how some of these jobs would be handled if it was not for this Lucas."

Note The many actual photographs of locomotive jobs on the Lucas, used in our advertisements, are definite proof that this time-tried machine is used extensively in railroad shops.

Write for circular A-45. It explains the details and many advantages of this powerful, versatile, convenient and accurate machine.

THE LUCAS MACHINE TOOL CO.

CLEVELAND OHIO

THIS CASE-HARDENED BUSHING OF *AGATHON NICKEL IRON* HAS BEEN BROKEN TO SHOW THE TOUGHNESS OF THE CORE . . . . . .

A Greater Toughness for Case-Hardened Parts

AGATHON NICKEL IRON IS IDEAL MATERIAL FOR HARDENED PINS AND BUSHINGS

MODERN metallurgy has brought to the railroads many materials with new qualities.

Now comes Agathon Nickel Iron to remove case-hardening difficulties and give greater dependability to pins, bushings and similar parts.

Uniform in composition all the way through and without slag spots or seams, this alloy iron gives a fine case and an unusually tough core.

Warping is almost negligible. Pins and bushings may be machined to size, polished, carburized, and quenched from the pot without spoiling the surface for smoothness. No grinding is necessary. The finished cost of case-hardened parts made of Agathon Nickel Iron is lower than ordinary iron.

Try this modern alloy iron for all case-hardened pins and bushings.

Central Alloy Steel Division

REPUBLIC STEEL CORPORATION

MASSILLON, OHIO

Two-Cylinder Super-Power Locomotives Do The Work of Mallets

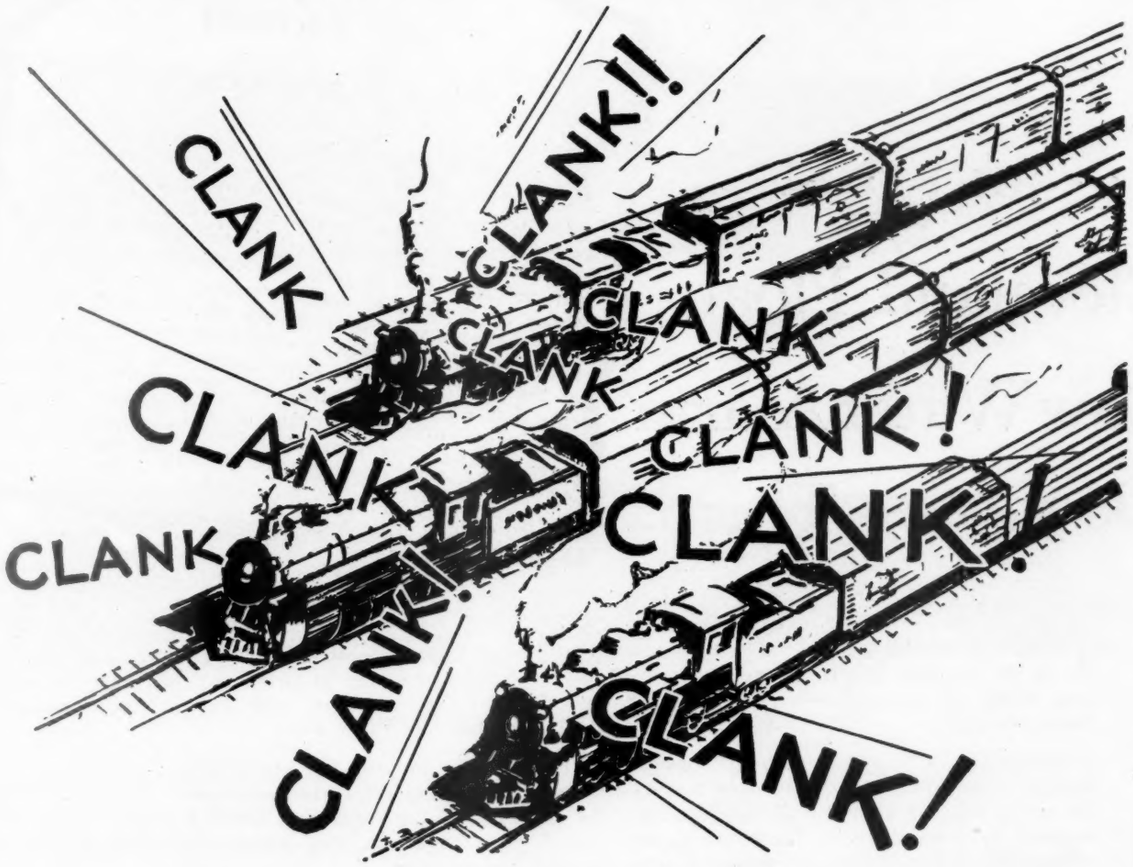
For the Chesapeake and Ohio Railway, Lima recently built the world's most powerful two cylinder locomotives of the 2-10-4 type.

They are being used in hauling heavy coal and ore trains and are replacing Mallets in this service, with the following results:

Increased train load
Increased speed of operation
Decreased fuel consumption
Decreased maintenance

The most striking result is the decrease in maintenance. One set of cylinders, drivers, rods, etc., now does the work of two sets on the Mallets.

LIMA LOCOMOTIVE WORKS, *Incorporated*
LIMA, OHIO



Every CLANK!
Marks a Step Toward the Back Shop

KEEP out the slack and you keep down repair costs.

But even though you set up ordinary driving box wedges as tightly as you dare, you must still leave a fraction of an inch for temperature rise when the engine is on the road.

This fraction of an inch grows under the shock of the piston thrust into the too familiar clank!

If you could only adjust the wedges as the locomotive runs, you could keep the slack from gaining a foot-hold.

Franklin Automatic Adjustable Wedges do just this. They adjust the wedges with every revolution of the drivers and reduce maintenance by preventing slack.

Every locomotive needs them.

FRANKLIN RAILWAY SUPPLY COMPANY, Inc.

NEW YORK CHICAGO ST. LOUIS SAN FRANCISCO MONTREAL

- - - and the Cleveland Float Low Water Alarm *Decreases* Them!

High Water Increases Maintenance Costs

IT is a well-known fact that the practice of carrying the water high in the boiler of a locomotive is the cause of failure to piston packing, cylinders, guides, pistons and superheater units. Nevertheless, little attention is given to the subject in the instruction of enginemen and it is frequently overlooked in the routine duties of the enginehouse foreman. One road in the east has been making a special effort during the past few months to instruct its enginemen in carrying water at the correct height. Reports recently received indicate that a big improvement has been made on the part of all enginemen on the road in correcting this bad practice, and there has been a reduction in repairs and shop expense in the maintenance of locomotive parts affected by high water

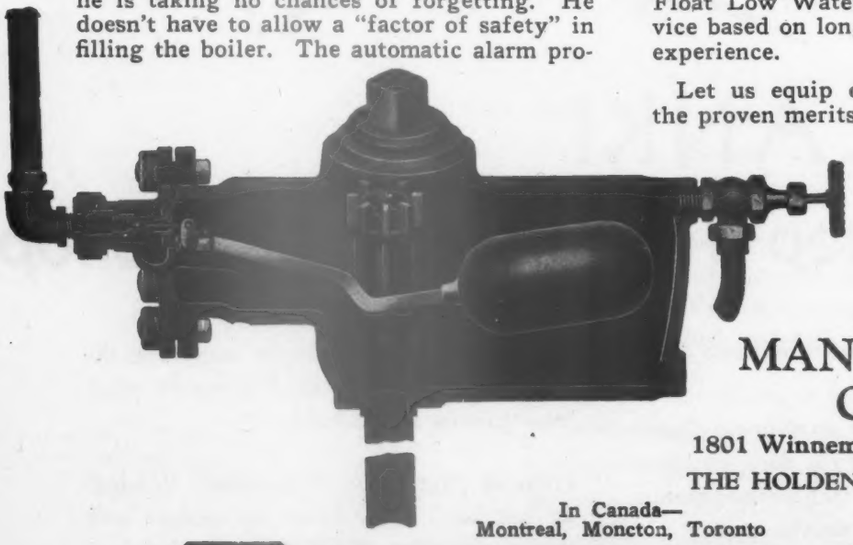
An editorial Published in "Railway Mechanical Engineer" for August

INSTRUCTING engine men to carry water at the correct height is much more effective when the incentive to keep it high has been removed.

With the Cleveland Float Low Water Alarm in service, an engine man knows that he is taking no chances of forgetting. He doesn't have to allow a "factor of safety" in filling the boiler. The automatic alarm provides that safety factor. He can—and will—keep the water at the level that insures best operating results and lowest maintenance costs.

You can *stop* the practice of carrying water high when you give your men the Cleveland Float Low Water Alarm—a practicable device based on long years of stationary boiler experience.

Let us equip one engine to demonstrate the proven merits of this device.



BARCO MANUFACTURING COMPANY

1801 Winnemac Avenue Chicago, Illinois

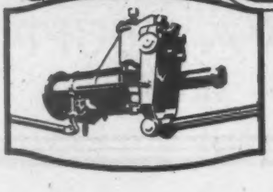
THE HOLDEN CO., LTD.

In Canada—
Montreal, Moncton, Toronto

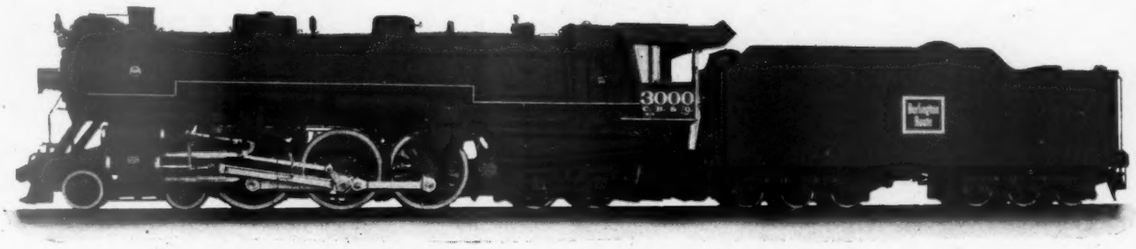
In Canada—
Winnipeg, Vancouver

BARCO

Railway Devices



The New Power on the Burlington

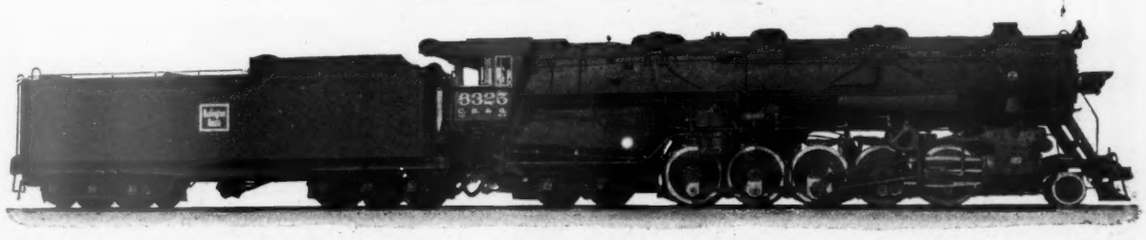


4-6-4 TYPE, CLASS S-4, FAST PASSENGER SERVICE

Cylinders	25" x 28"	Superheating surface	1830 sq. ft.
Drivers, diameter	78"	Weight on drivers	207,730 lb.
Steam pressure	250 lb.	Weight, total engine	391,880 lb.
Grate area	87.9 sq. ft.	Tractive force, main cylinders	47,700 lb.
Water heating surface	4247 sq. ft.	Tractive force, with booster	59,400 lb.

4-8-4 TYPE, CLASS O-5, FAST FREIGHT SERVICE

Cylinders	28" x 30"	Water heating surface	5317 sq. ft.
Drivers, diameter	74"	Superheating surface	2403 sq. ft.
Steam pressure	250 lb.	Weight on drivers	271,680 lb.
Grate area	106.5 sq. ft.	Weight, total engine	454,590 lb.
Tractive force	67,500 lb.		



2-10-4 TYPE, CLASS M-4, HEAVY FREIGHT SERVICE

Cylinders	31" x 32"	Water heating surface	5904 sq. ft.
Drivers, diameter	64"	Superheating surface	2487 sq. ft.
Steam pressure	250 lb.	Weight on drivers	355,510 lb.
Grate area	106.5 sq. ft.	Weight, total engine	511,710 lb.
Tractive force	90,000 lb.		

1831 BLW 1930

THE locomotives illustrated represent types that successfully meet present-day requirements on American railroads. Scrapping of old power and replacing it with strictly modern units specially designed for the work to be done, is sound economy.

THE BALDWIN LOCOMOTIVE WORKS

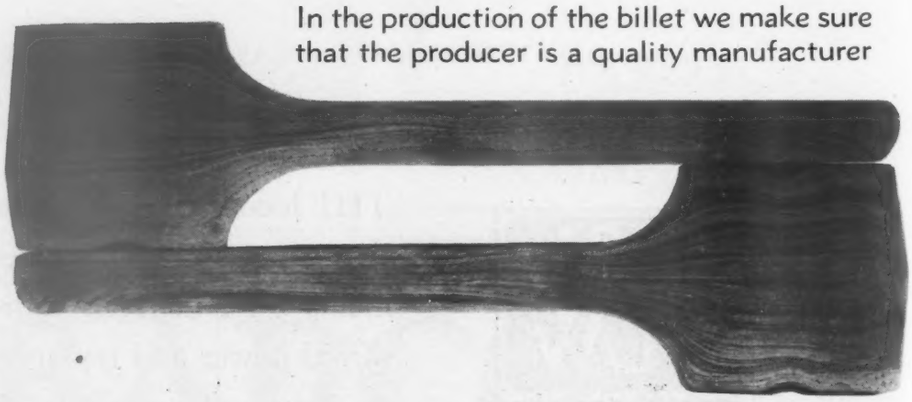
PHILADELPHIA

ALCO
FORGINGS

UPON every forging manufactured by Alco and sent forth under its name, rests a responsibility that is not measured by its price alone.

Alco forgings and the service they render have fully demonstrated the value of the special manufacturing methods we employ.

In the production of the billet we make sure that the producer is a quality manufacturer



AMERICAN LOCO
30 CHURCH STREET

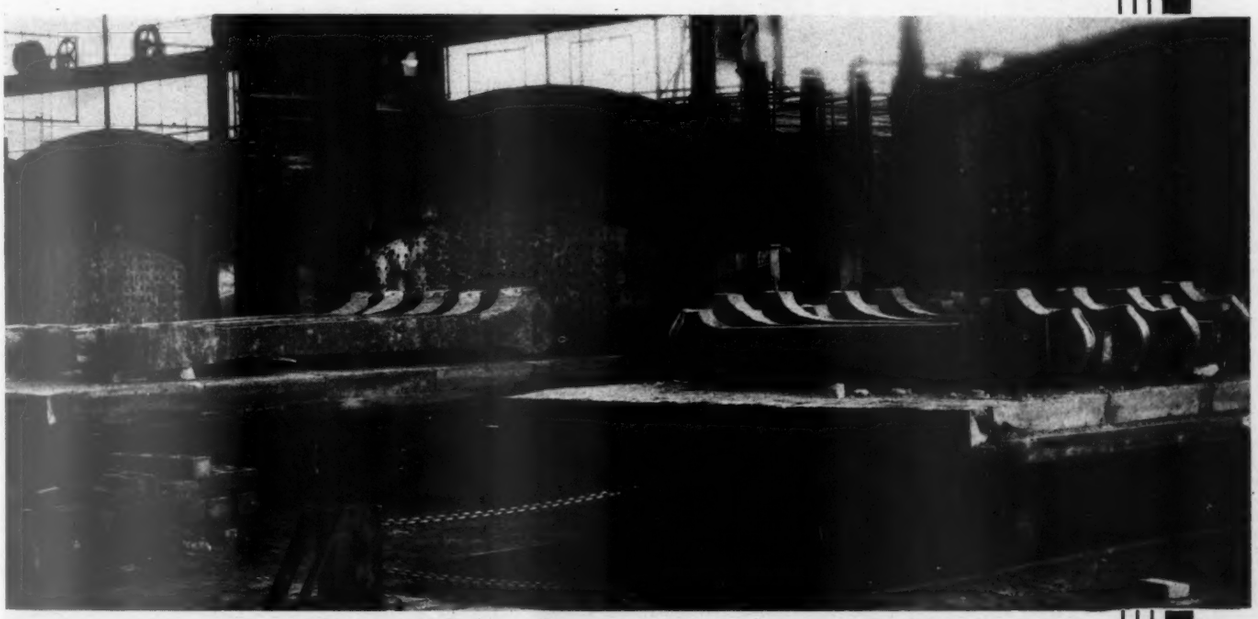
—one who selects his melting charges taking time to see that the steel is properly refined in the open hearth furnace before being tapped.

We see to it that the steel is poured into correctly designed ingot moulds with a liberal hot top. This draws the piped or segregated area up into that portion of the ingot which is later discarded.

In heating for rolling or pressing we make sure that ample time is taken to make certain the heat has penetrated uniformly throughout the mass.

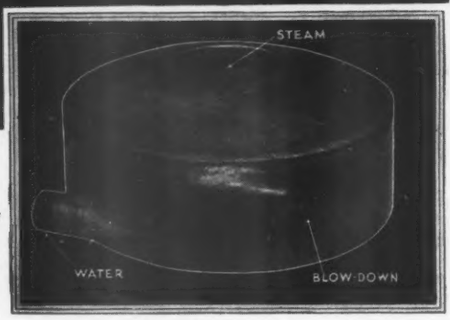
Drillings are taken from all heats and sent to our laboratory for complete chemical tests before billets are released for shipment.

There can be no compromise with quality in forgings. Today, when locomotives must perform satisfactorily under the most severe conditions, Alco forging equipped locomotives prove their worth as nothing else could.



COMOTIVE COMPANY
NEW YORK CITY

B-A Blow-off Muffler in Operation



B-A Blow-off Muffler

NOW . . .

YOU CAN BLOW YOUR ENGINES *regardless* OF WIND OR WAYSIDE CONDITIONS

The B-A Blow-off Muffler effectively separates water from the steam by centrifugal action.

Located on top of the boiler—steam goes straight up in the air like the discharge of the pops—water is discharged to the ground.

No digging up of ballast—no dirt thrown into bearings—no danger to switch and yard men.

Boilers can be blown off when they ought to be blown, regardless of wind direction or wayside conditions.

B-A Safety Connection

Renders impossible an unsafe connection to roundhouse lines but permits a connection without disturbing the muffler. Only necessary to unscrew wing nuts and open the hinged cap.

B-A Safety Connection and B-A Blow-off Cock

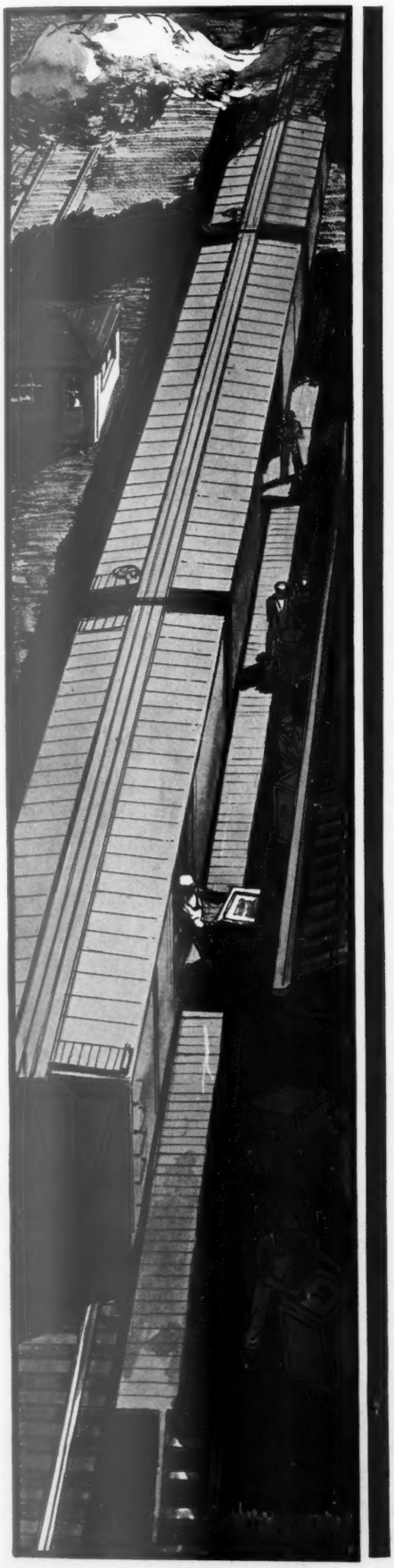
The manufacture, supply and service of boiler water treatment chemicals is the primary business of The Bird-Archer Company.

These activities and expert services properly include the installation and service of mechanical devices, likewise designed to promote locomotive boiler efficiency.

THE BIRD-ARCHER COMPANY

NEW YORK • CHICAGO • ST. LOUIS

The Bird-Archer Company, Limited, Montreal



"ROUTE VIA"?

THE pace of modern business makes shippers alert to seize every advantage in routing via the most dependable fast line.

To keep their business it is vital that schedules be maintained. Delays and breakdowns on the road cause claims and lose business for the road.

National Draft Gears are the finest car protection ever devised — by preventing damage to cars, they prevent delays and help maintain schedules that increase the routing via your road.

THE NATIONAL MALLEABLE & STEEL CASTINGS CO.
General Offices: CLEVELAND, OHIO

Sales Offices: NewYork, Philadelphia, Washington, Chicago, St. Louis, San Francisco
Works: Cleveland, Chicago, Indianapolis, Sharon, Pa., Melrose Park, Ill.

NACO STEEL
Trade Mark Registered

NACO Steel is a product of the electric furnace. Tougher and more resistant to shock and wear than any alloy ever before used in draft gear manufacture.

M17 National Draft Gear

NATIONAL
ELECTRIC NACO STEEL
DRAFT GEARS

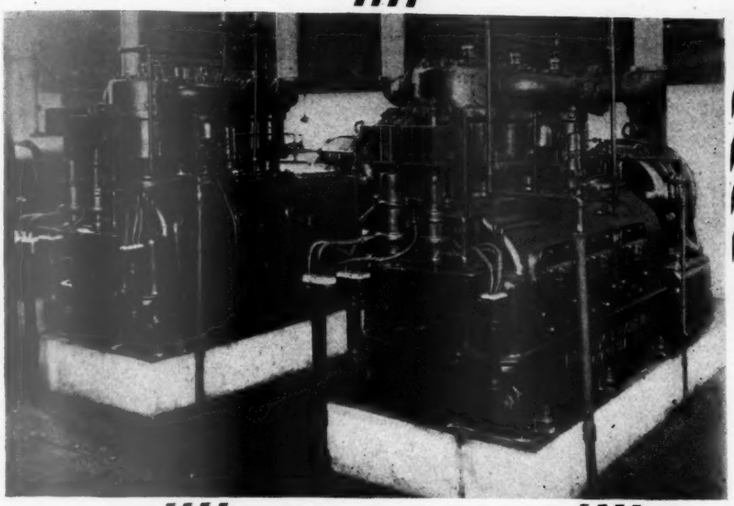
A DRAFT GEAR FOR EVERY PURPOSE

THE National M17 Draft Gear is the standard gear for all classes of freight cars. However, when a gear is required for replacement purposes on cars where the sill spacing is not of standard size or where other unusual conditions exist several other types of National Gears are available. Each of these is designed and built to National's rigid standards of engineering, workmanship and material. Each of them represents the greatest amount of car protection per dollar invested, for the work they are intended to do.

THE NATIONAL MALLEABLE & STEEL CASTINGS CO.
General Offices: CLEVELAND, OHIO
Sales Offices: New York, Philadelphia, Washington, Chicago, St. Louis, San Francisco
Works: Cleveland, Chicago, Indianapolis, Sharon, Pa., Melrose Park, Ill.

NATIONAL
ELECTRIC NACO STEEL
DRAFT GEARS

Where **DURABILITY** *is outstanding there you'll find*



WESTINGHOUSE-NATIONAL Air Compressors

Trouble-free service year after year is common with Westinghouse-National Air Compressors. They are built to endure. Reliability and low maintenance are their outstanding characteristics. Hundreds of them are being used by railroads, with marked success, for every conceivable pneumatic requirement... The two machines illustrated-3VS-24, 335 cu. ft. displacement - have been in constant service day and night since 1923, furnishing air for yard charging and shop use. No maintenance work has been needed during this time other than the grinding of valves, and the compressors are good for many more years of service. Scores of their predecessors have been in use for fifteen to twenty years. . . . . .

WESTINGHOUSE AIR BRAKE CO.

General Office and Works WILMERDING, PA.

SYPHONS
Prevent Disastrous Explosions

Explosion caused by crown sheet failure due to low water. Result: two deaths, three seriously injured and heavy financial loss.

Another explosion caused by low water, resulting in the death of engineer and fireman and property damage of $32,500.

From the Seventeenth Annual Report

Chief Inspector—Bureau of Locomotive Inspection
Interstate Commerce Commission

"There seems little question that where fireboxes are equipped with Thermic Syphons, properly applied, such explosions (as illustrated above) will be avoided by hindering any great area of the crown sheet from becoming overheated due to low water prior to the failure of the sheet in front of or between the Syhons, thus precluding the probability of the entire crown sheet being blown down or the firebox from being blown out."

Typical case of low water in a Syphon-equipped locomotive. Damage was slight with no fatalities nor injuries.

LOCOMOTIVE FIREBOX COMPANY
NEW YORK CHICAGO MONTREAL

BETTER FIRES

FIREBAR CORPORATION
CLEVELAND OHIO.

Locomotive cylinders cast from Alco Ni-Iron by AMERICAN LOCOMOTIVE CO., New York.

Physical and Structural Characteristics of
ALCO NI-IRON

Transverse strength in excess of 4000 lbs.° Hardness approximately 225 BHN°. Fully pearlitic matrix. Minimum of hard, free cementite. Finely divided graphite.

°As tested in standard arbitration bar.

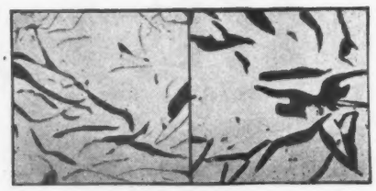
ALCO NI-IRON...

an improved material for modern railway service

AT A TIME when railroads throughout the country are employing every effort to reduce costs and at the same time provide efficient passenger and freight transportation, the introduction of Alco Ni-Iron assumes special importance.

Alco Ni-Iron, produced by the American Locomotive Co. from a special base mixture containing Nickel, was developed to meet the need for an alloyed cast iron having exceptional strength, toughness and wear-resistance. In locomotive construction Alco Ni-Iron provides longer wear and improved resistance to impact and operating stresses in such parts as cylinders, cylinder bushings, pistons, piston rings, piston valve bushings, valves, packing rings, shoes and wedges.

Because it retains, in the center of heavy sections, a higher percentage of its arbitration bar strength, Alco Ni-Iron is particularly adaptable for heavy castings. Tests on 4" sections turned to 1¼" dia. showed an average tensile strength of 28,000 p.s.i. as against 15,000 p.s.i. for gray iron. These same irons cast in standard arbitration bar sections—1¼" dia. tested 40,000 p.s.i. for Alco Ni-Iron and 32,000 p.s.i. in gray iron. Yet the additional cost represented by the Nickel addition is so small in proportion that it can scarcely be a factor to the railroad seeking longer-wearing material.



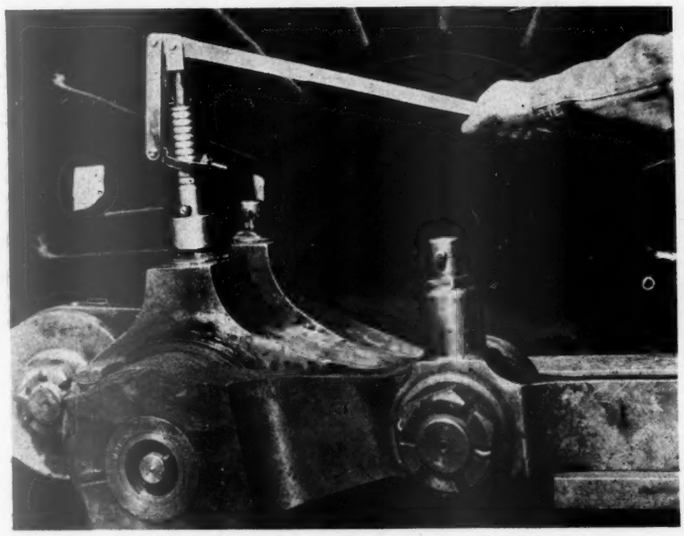
Above: *Left*
Photomicrograph taken from 4" dia. test bar of Alco NI-Iron

Above: *Right*
Photomicrograph taken from 4" dia. test bar of regular cylinder iron

Magnifications x 100

Our casting specialists will gladly discuss your problems with you.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.



Saves Time -and Time is Money

THE new "SPEE-D" High Pressure Universal Grease Gun can be attached and bearing lubricated in less than 30 seconds.

It can be applied to fittings with connecting rods in any position, locomotives do not have to be moved.

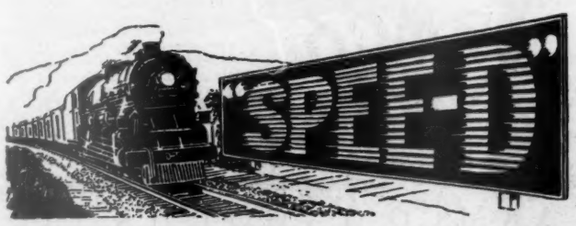
Used with Standard "SPEE-D" Fittings.

RELIANCE MACHINE & STAMPING WORKS, Inc.

NEW ORLEANS, LA.

Agents and Representatives

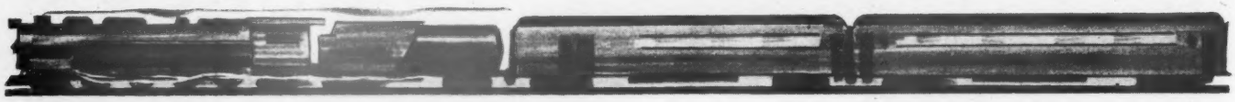
H. C. MANCHESTER, 3736 Grand Central Terminal, New York City
Consolidated Equipment Company, Montreal
Mumford Medland, Ltd., Winnipeg
International Railway Supply Company, 30 Church St., New York City



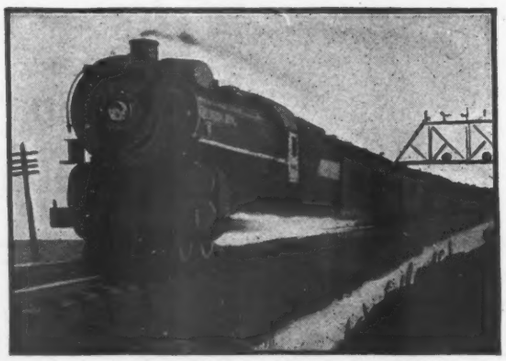
also saves Labor, Grease and Grease Plugs

Trade Mark Registered

ARMCO INGOT IRON promotes more and profitable

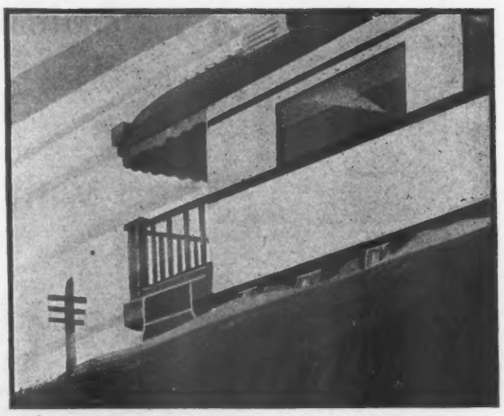


CAR-MILEAGE



IN hopper cars and gondolas, passenger train cars, baggage cars and refrigerator cars, Armco INGOT IRON is demonstrating to the country's leading railroads its unusual economy. Their investment in this durable iron yields long, trouble-free service—the kind of performance that promotes more and profitable mileage.

Here is the iron that has been tested and approved by the years. For more than two decades it has endured under all kinds of adverse conditions—the longest record of *actual service* of any low-cost, rust-resisting plates and sheets. Besides durability are these plus-values that reduce shop production costs and assure sound, long-lasting construction: workability, weldability, fine surface finishes, and consistent uniformity.



Railroad Mechanical Departments will do well to investigate this tried-and-proved iron. The office nearest you will be glad to cooperate by placing an experienced engineer at your disposal. He will study your problems and suggest the most adequate and economical material. Write for this helpful service.

TUNE IN—*The Famous Armco Concert Band Broadcasts every Thursday Night, WLW—700 K., Cincinnati Nine to nine-thirty E. S. T.*

THE AMERICAN ROLLING MILL COMPANY

Executive Offices, Middletown, Ohio

Export: The ARMCO International Corporation

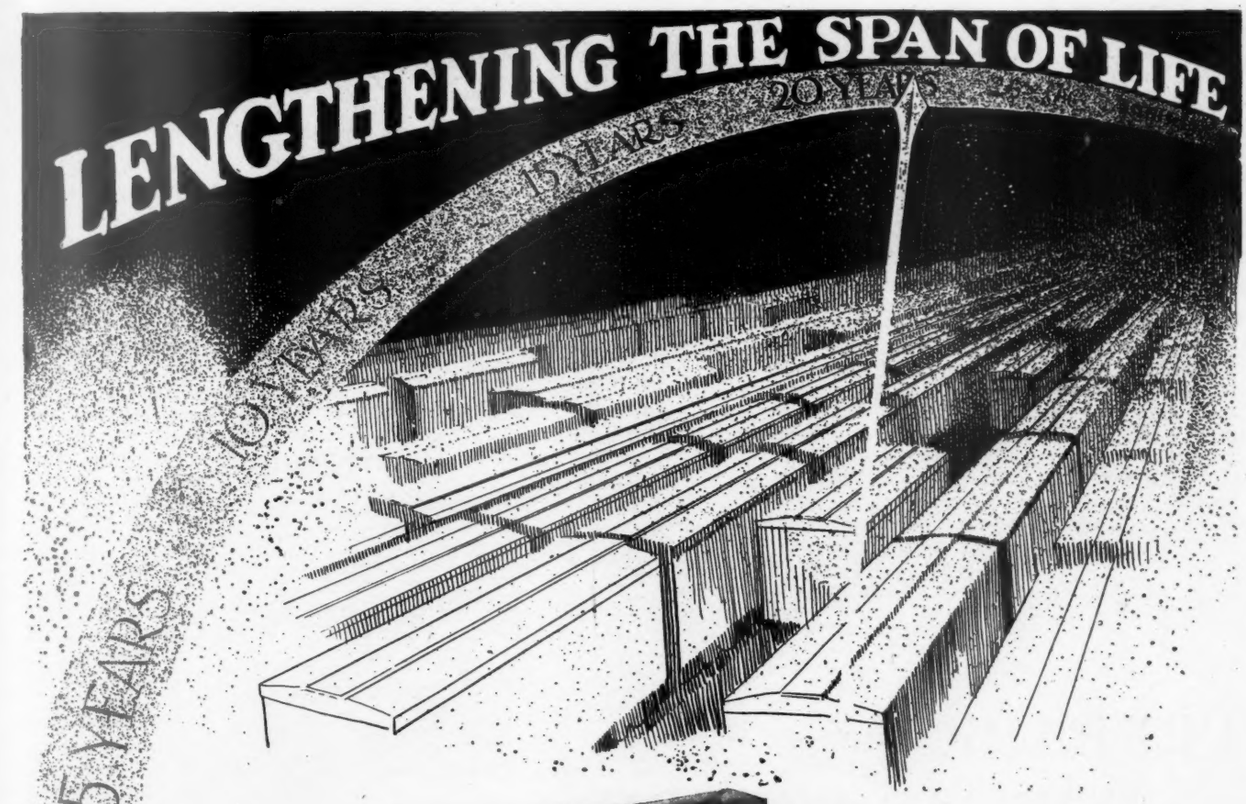
DISTRICT OFFICES: Chicago, Cincinnati, Cleveland, Detroit, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco

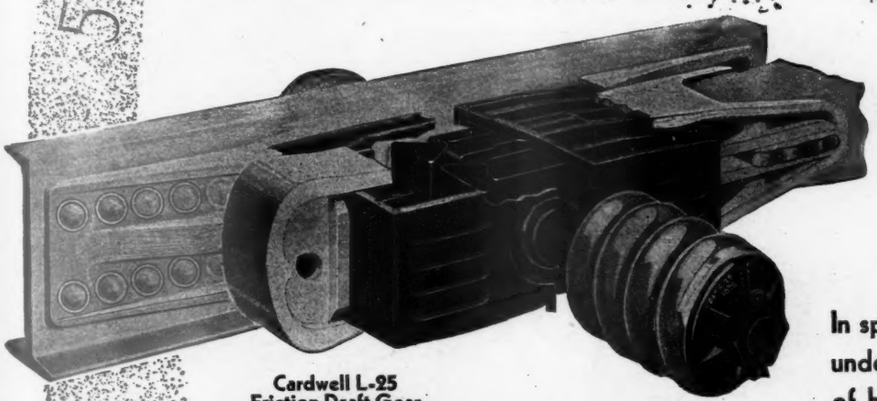
ARMCO

Back of this familiar symbol is nearly thirty years' experience in the manufacture of special analysis iron and steel sheets and plates. When you want a rust-resisting, low-cost metal, be sure to see this triangle and the words, "Armco INGOT IRON." It is your assurance of dependable, economical service.

"BE SURE IT'S MADE OF ARMCO INGOT IRON"

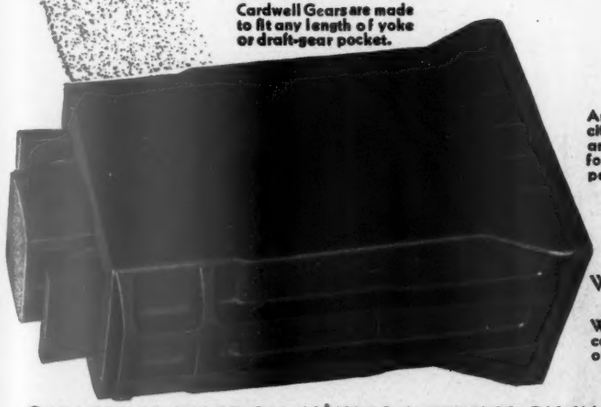
LENGTHENING THE SPAN OF LIFE





Cardwell L-25 Friction Draft Gear
Cardwell Gears are made to fit any length of yoke or draft-gear pocket.

Cardwell and Westinghouse Draft Gears
Are made in sizes and capacities to meet all modern and A. R. A. requirements for locomotives, freight and passenger cars.



Westinghouse NY-11-D Friction Draft Gear
Westinghouse Draft Gears can be applied with any type of attachments.

In spite of the strenuous conditions under which we now live, the span of human life has been measurably increased by scientific preventive and protective measures.

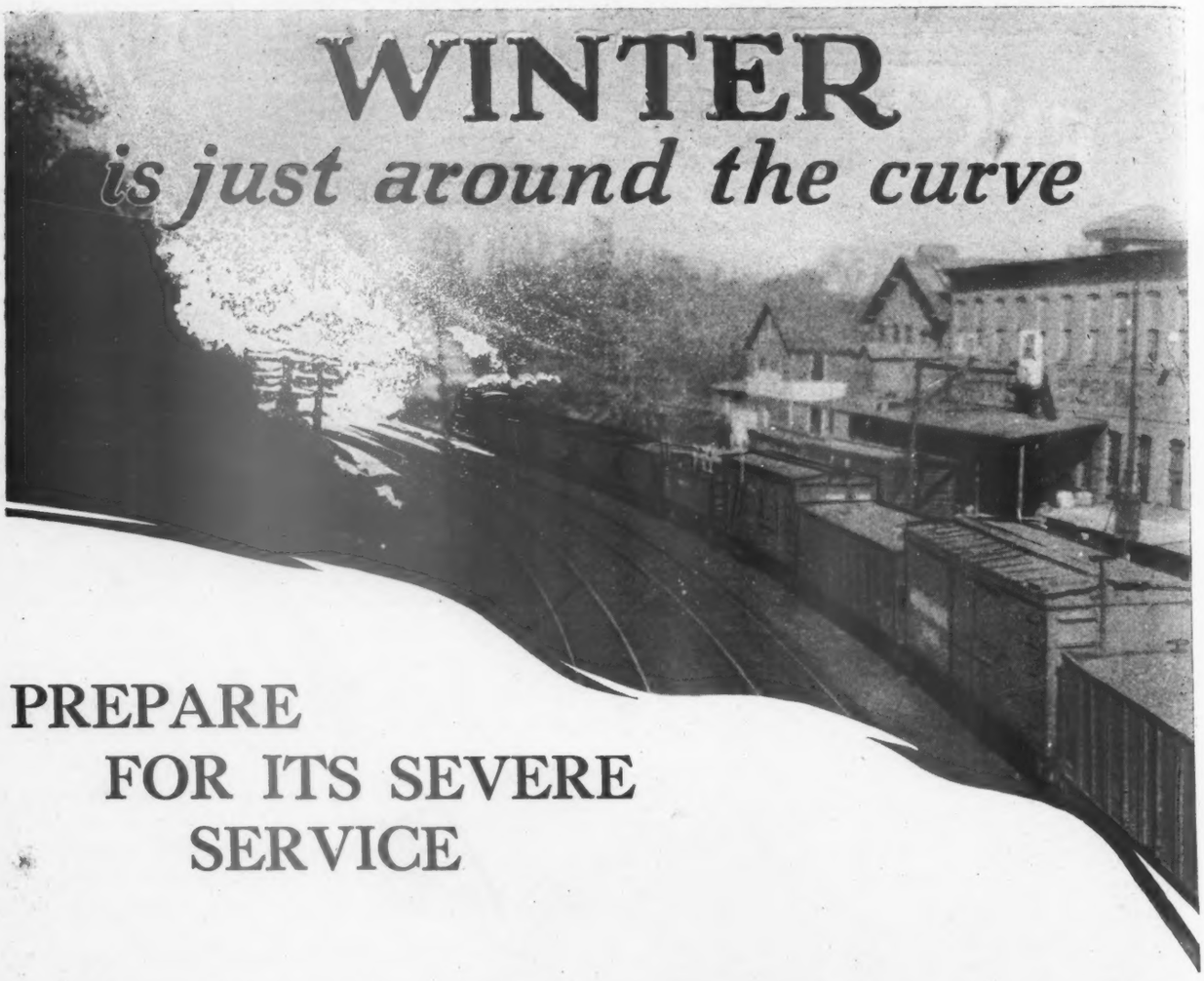
Likewise the span of life of cars, now subjected to service more severe than ever before, can be lengthened by replacing inadequate draft gears with the new Cardwell or Westinghouse Draft Gears.

GREATER PROTECTION INSURES A REDUCTION IN CAR MAINTENANCE AND DAMAGED-LADING COSTS

CARDWELL WESTINGHOUSE COMPANY

332 South Michigan Avenue » » Chicago, Illinois

PITTSBURGH, PENNSYLVANIA MONTREAL, QUEBEC, CANADA



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FOR ITS SEVERE
SERVICE

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Will Eliminate Your Worries With Doors Frozen Shut

THEY PROVIDE A DEVICE SO ARRANGED TO ENABLE A FROZEN DOOR TO BE SAFELY PRIED OPEN AS WELL AS CLOSED.

Peoples Gas Bldg.
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The Safest and Most Economical

Wine DROP DOOR Locks

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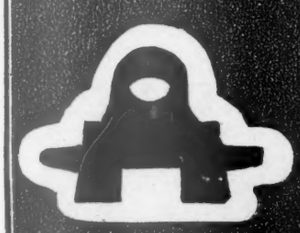

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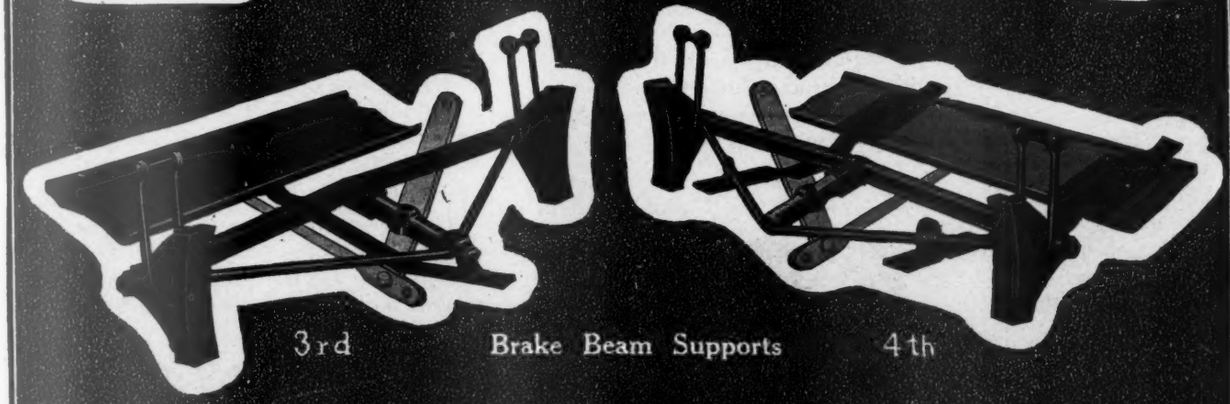
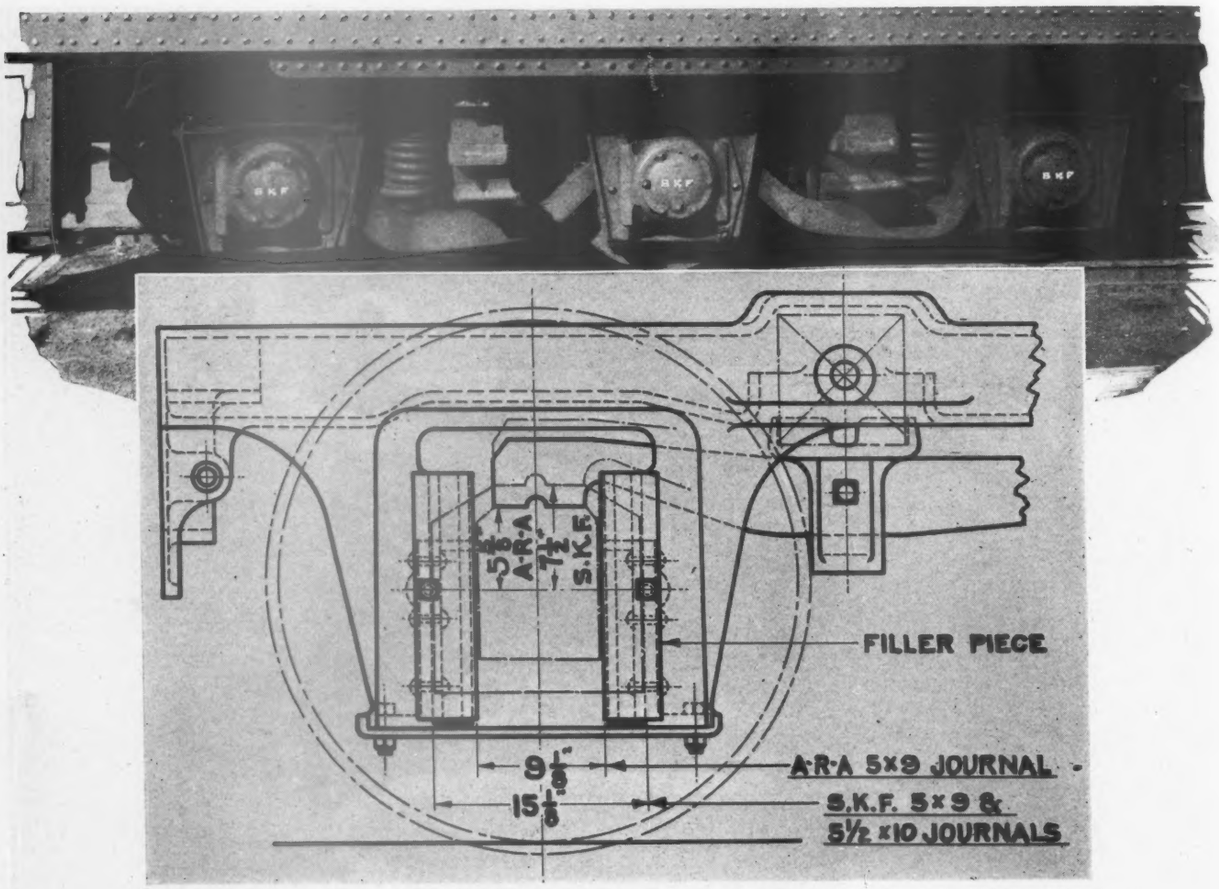


3rd Brake Beam Supports 4th

Chicago Railway Equipment Co.



Provide Room Enough For A Proper Bearing

HIGH bearing capacity is essential to the continuity of service expected of the roller bearing.

Without ample capacity, roller bearing performance is erratic. Hence the folly of trying to squeeze a roller bearing into too small a space.

Because of its two rows of rollers and equal load distribution, the SKF Journal Bearing provides maximum capacity in a given space. But the space must be big enough to contain the proper bearing for the load involved.

Experience has shown it is not desirable to confine an anti-friction bearing within the radial space requirements of a plain bearing. Not only does this apply to railroad car journals but it is sustained by every successful industrial application.

Therefore in the new truck designs provide plenty of room for an anti-friction bearing of the proper capacity, regardless of the type of bearing initially applied.

SKF INDUSTRIES INCORPORATED
40 East 34th Street New York, N. Y.

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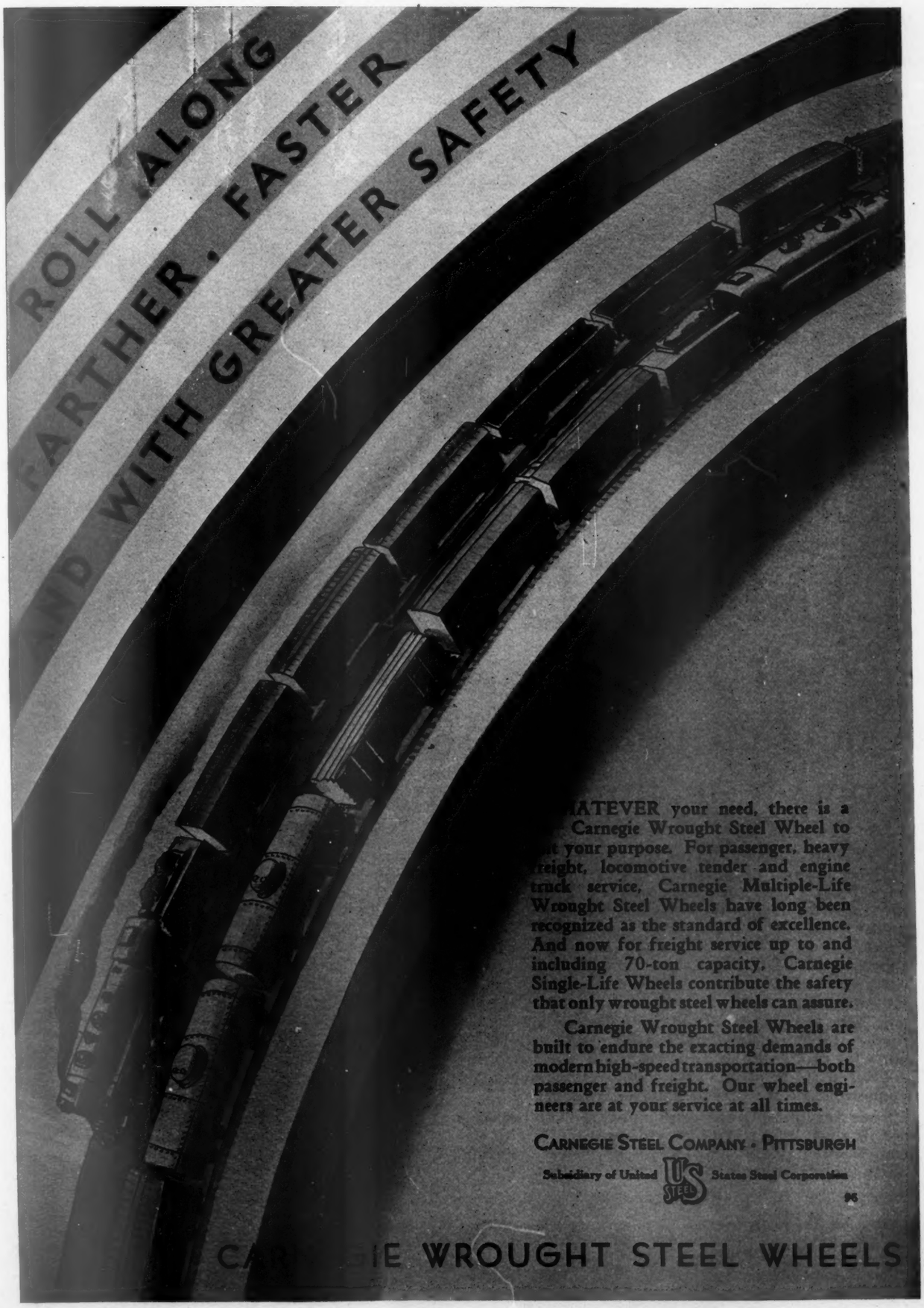
SKF
JOURNAL BEARINGS


ROLL ALONG
FARTHER, FASTER
AND WITH GREATER SAFETY
ATEVER your need, there is a Carnegie Wrought Steel Wheel to t your purpose. For passenger, heavy reight, locomotive tender and engine truck service, Carnegie Multiple-Life Wrought Steel Wheels have long been recognized as the standard of excellence. And now for freight service up to and including 70-ton capacity, Carnegie Single-Life Wheels contribute the safety that only wrought steel wheels can assure.
Carnegie Wrought Steel Wheels are built to endure the exacting demands of modern high-speed transportation—both passenger and freight. Our wheel engineers are at your service at all times.
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Subsidiary of United States Steel Corporation
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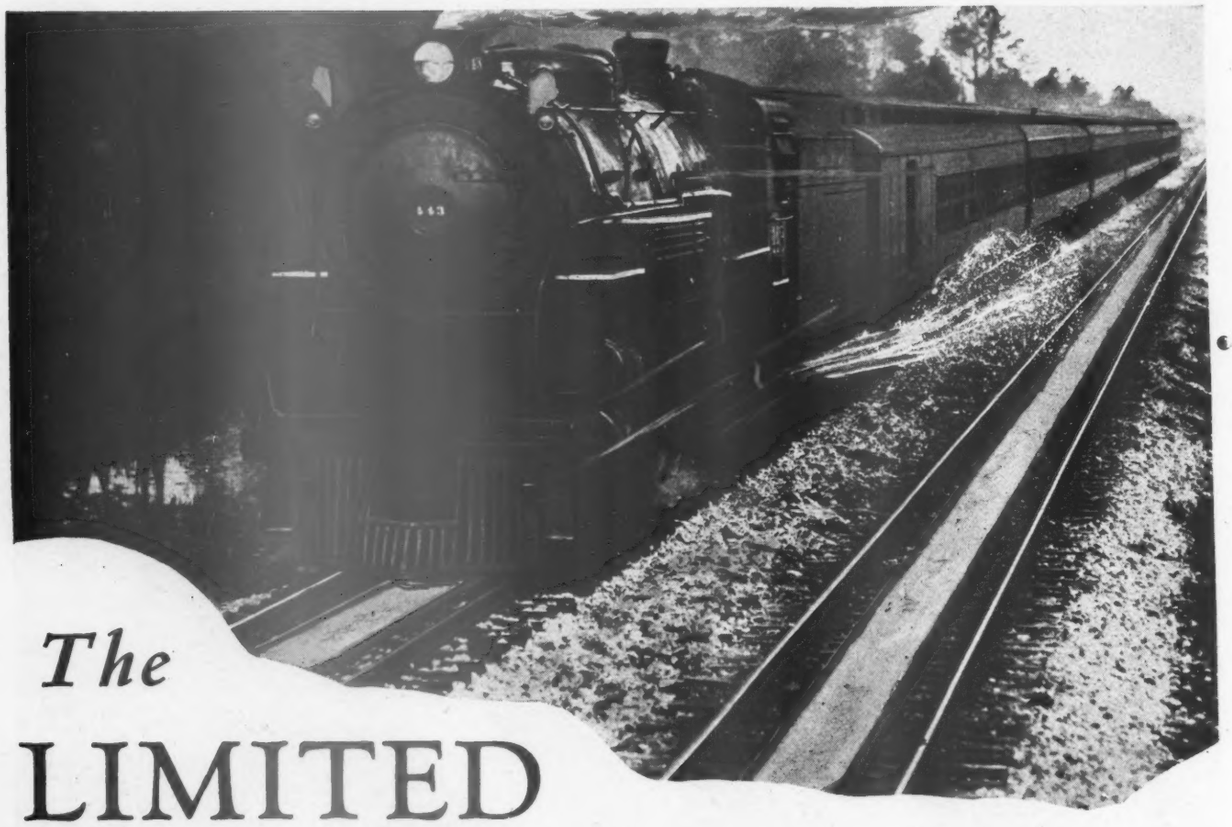


The

LIMITED

doesn't stop for water

Out of the track tank she scoops it up, throttle open

NEITHER should your shop schedules be held up on account of cleaning! OKEMCO in the backshop tank is your guarantee of NO DELAYS in removing the most stubborn deposits of muck and grease from air-brake parts, valve gear, trucks, drivers, driving rods, and all difficult, heavy-duty parts. A short soak in OKEMCO, then a rinse with a pressure hose, and parts are clean to the metal, ready for inspection and repair.

And very important ... OKEMCO saves money! A surprisingly small amount does the toughest job, without a lot of scrubbing and scraping. Another thing — OKEMCO solutions are long-lasting, requiring infrequent additions of material for upkeep.

Let our Service Man in your vicinity tell you how this safe, modern material is providing some of the nations leading roads with safe, economical cleaning. Write us and he will call.

OAKITE PRODUCTS, INC. 46 Thames St., New York, N. Y.

OKEMCO

TRADE MARK REG. U. S. PAT. OFF.

A basketful of parts going into the OKEMCO tank at a prominent railroad shop.

Dependable materials are the best assurance of dependable performance

Superior TOUGHNESS *and* UNIFORMITY *have led to the adoption of Nickel Steel Forgings by leading railroads*

STANDARD STEEL WORKS COMPANY

DEPARTMENT OF TESTS

Burnham, Pa., 12/11/29.

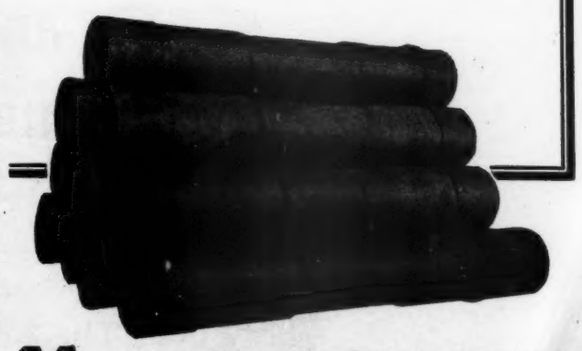
REPORT OF NORMALIZED AND TEMPERED CARBON NICKEL STEEL FORGINGS:

Material	Yield Point lbs. per sq. in.	Tensile Strength	Elong. % in 2"	Red. of Area %	Chem. Analysis % Carb.	% Mang.	% Nickel
Crank Pins	55750	83000	29.5	62.5	.27	.88	2.50
Crank Pins	57500	84000	30.0	61.5	.27	.88	2.50
Crank Pins	58500	82500	29.0	63.5	.27	.88	2.50
Crank Pins	57000	82500	31.0	63.5	.27	.88	2.50
Crank Pins	62500	92000	29.0	61.5	.27	.88	2.50
Crank Pins	66510	84500	28.5	62.5	.26	.82	2.73
Crank Pins	60500	86000	31.0	65.0	.26	.82	2.73
Crank Pins	65000	89500	29.5	61.5	.27	.99	2.88
Crank Pins	62000	90000	29.5	62.5	.27	.99	2.88
Crank Pins	58000	80500	29.5	67.0	.22	.87	2.72
Connecting Rods	56000	84000	28.5	60.0	.27	.88	2.50
Connecting Rods	56000	84000	28.5	60.0	.27	.88	2.50
Crosshead Keys	58500	84000	31.0	63.5	.27	.88	2.50
Crosshead Keys	61000	84500	30.0	62.5	.26	.82	2.73
Crosshead Keys	62000	82500	30.5	67.0	.22	.87	2.72
Crosshead Keys	59000	86000	30.5	66.0	.22	.87	2.72
Driving Axles	60500	87000	28.0	61.5	.19	1.00	3.09
Driving Axles	55500	82500	28.0	60.0	.26	.82	2.73
Driving Axles	56500	84500	29.0	61.5	.26	.82	2.73
Driving Axles	56500	83000	29.5	60.0	.26	.82	2.73
Driving Axles	63500	89500	28.5	62.5	.27	.99	2.88
Driving Axles	64000	90500	28.5	61.5	.27	.99	2.88
Driving Axles	56000	81500	28.5	60.0	.22	.87	2.72
Driving Axles	64500	90500	28.5	62.5	.22	.87	2.72
Driving Axles	57000	81000	30.5	65.0	.22	.87	2.72
Driving Axles	58500	85500	29.0	62.5	.22	.87	2.72
Driving Axles	61000	82000	30.0	60.0	.23	.94	2.66
Driving Axles	59900	83500	29.0	61.5	.23	.94	2.66
Driving Axles	58000	86500	30.0	61.5	.23	.94	2.66

EXPERIMENTS with various grades of alloy steels conducted by leading railroads and locomotive manufacturers in the United States and Canada during the past few years have resulted in an ever-increasing use of Nickel Steel forgings in locomotives.

It has been proved that Nickel Alloy Steel axles, main and side rods, crank pins, etc. will stand up under severe abuse in operation, and at the same time provide mechanical properties that permit weight to be kept down to a minimum. Also, the use of Nickel to increase the strength of steel has permitted a reduction in carbon content, thus assuring a high degree of ductility while retaining a yield point sufficiently high for an ample factor of safety.

Detailed information on the properties and use of Nickel Alloy Steels is available for the solution of your problems, and will be gladly furnished by our staff of engineers.



Nickel FOR ALLOY STEEL

Nickel Alloy Steel locomotive axle forgings, after annealing, produced by STANDARD STEEL WORKS CO., Burnham, Pa. for Northern Pacific Railway—(Silas Zwight, gen. supt., motive power; H. C. Burnham, engineer of tests).

Send for "Buyers' Guide to Nickel Alloy Steel Products", and List of Available Publications on Nickel Alloys

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

Greetings and a Tribute

With pardonable pride, The J. B. Ford Company looks back over a record of more than thirty-three years,—a third of a century—of significant service to commerce and industry.

Anticipating the need of industry for scientific sanitation and cleanliness, the Wyandotte Products became the pioneers in the field of modern cleaning standards.

Outstanding in this record of successful accomplishment is the loyalty of our thousands of friends without whom our best efforts would have been of no avail.

Realizing this, we are sincerely glad at this good-will season of the year to extend to our friends in every field of business activity our most hearty wishes for a

Merry Christmas and A Prosperous New Year

The J. B. Ford Company
Wyandotte, Michigan

HEAVY LOADS »» HIGH SPEED SERVICE

Another example of Shafer Roller Bearing performance under heavy loads in high speed service is this application on the 15 new baggage mail cars of the New Haven Railroad

SHAFER
SELF-ALIGNING
ROLLER BEARINGS

Cartridge Unit
Cylindrical housing, machined on the outside. Shaft may be removed without disturbing bearing assembly.

Hanger Box
Can be used in any 4-point hanger. Rugged, easily installed.

Pillow Block
A compact, rugged unit, for machine and general power transmission purposes.

Duplex Unit
Designed to be pressed into a straight bore of machine frames.

Flange Unit
To be bolted to machine frame, which need not be machined. Also used as step bearing for vertical shafts.

These Shafer Roller Bearing Units are carried in stock in a full range of standard sizes. Special housings can be furnished to meet individual requirements. Write for catalog giving capacities and dimensions.

SHAFER BEARING CORPORATION, 6501-99 West Grand Avenue, Chicago, Illinois

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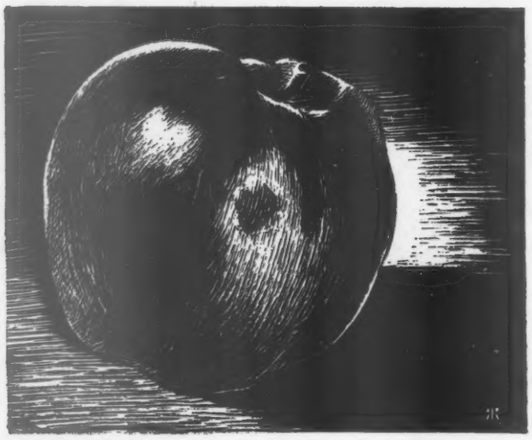


It's a good apple

There is only one bad spot in it. But through that single flaw the whole apple will soon be rotten to the core.

It's a good boiler — but the rivets or the staybolts are of poor quality. They are the weak spots which some day will send the locomotive back to the repair shop for expensive replacements.

The use of Burden Iron for rivets and bolts postpones indefinitely these expensive replacements.

Burden Iron for rivets or bolts is as free from impurities and flaws as careful manufacture and knowledge can make it. In the long run, the absolute economy of buying Burden quality and service convinces the most doubtful.

Take our word for this until Time proves it to you, and let us quote on your next lot of iron for rivets and bolts.

The Burden Iron Company

Troy, N. Y.

New York, N. Y. Chicago, Ill.

BURDEN
IRON RIVETS

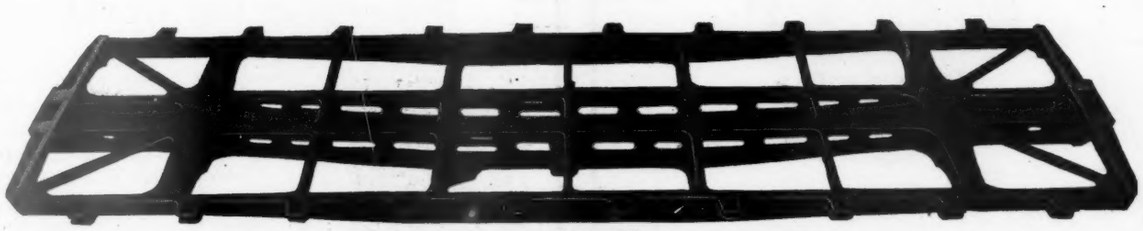
COMMONWEALTH

Cast Steel Freight Car Underframe

Combines in a Single Steel Casting the Entire Underframe of the car including Sills, Body Bolsters, Draft Gear Pockets, Striking Castings, Coupler Supports, Needle Beams, Cross Transoms and Brake Cylinder Brackets. Eliminating all Plates, Angles, Rivets and Miscellaneous Parts Necessary in an Assembled Underframe.

Strength Greatly Increased—Maintenance Eliminated.

Commonwealth One-Piece Cast Steel Underframes can be designed for All Types of cars.



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GENERAL STEEL CASTINGS CORPORATION

GRANITE CITY, ILL. EDDYSTONE, PA.

DIXON'S
Flake Graphite

Recognized the world over as the standard lubricating graphite. Used alone, or as an auxiliary lubricant with oils and greases, Dixon's Flake Graphite materially increases the operating efficiency of every machine it is used on.

Even tho Dixon's Flake Graphite has been used by thousands of mechanics, maintenance men and engineers for more than 100 years—do you know the . . . how . . . and . . . why . . . of Dixon's Flake Graphite lubrication?

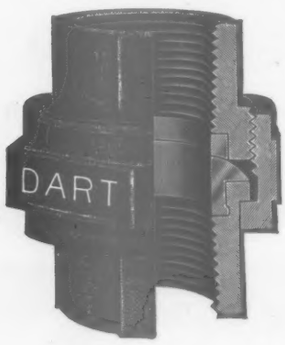
Joseph Dixon Crucible Co., Jersey City, N. J.

Established 1827

Two Bronze Spherical Seats in combination with Malleable Pipe Ends give the

DART UNION

a distinctive feature which has been unequaled. It is the acknowledged leader



E. M. DART MFG. CO., Providence, R. I.
THE FAIRBANKS CO. & BRANCHES, Distributors

Canadian Factory
DART UNION CO., Ltd., Toronto

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The buying of advertising space used to be buying a thing blindly. The quantity and quality of circulation was shrouded in mystery and often the bag was tied against investigation.

That day has passed. The Advertiser no longer depends upon "mere claims." The Audit Bureau of Circulations has untied the strings to the sack and the circulation of the better class of publications is thrown open for the most searching scrutiny.

In buying advertising space in **The Railway Mechanical Engineer** you are not buying blindly. Our A. B. C. statements will stand the analysis of the most exacting investigator.

Christmas Gift Books for RAILROADERS

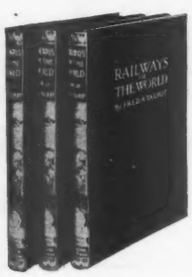
Who's Who in Railroading

Any railroad official would like to have a copy of the new Ninth Edition of this Who's Who of the railroad industry. It contains biographical sketches of 4000 leading railroad men of the United States, Canada, Mexico and Cuba. This book is just off the press and the data is based upon original questionnaires.

6 x 9 inches, 600 pages, royal blue cloth stamped in real gold, $8.50

Railways of the World

By Fred A. Talbot



The new three volume edition describes and pictures railway wonders in all parts of the world. The excellent illustrations include many photogravures and double page plates. The set is handsomly bound and stamped in gold. Any railroad man would enjoy reading these books.

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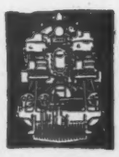

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Manning, Maxwell & Moore, Inc.
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Brakes, Hand.
National Malleable & Steel Castings Co.
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Wine Railway Appliance Co.

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Castings, Malleable.
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The cost of Dearborn Treatment is as uniformly low as is possible in the production and servicing of a 100% product. In proof of its effectiveness Dearborn customers are regular customers who continue to use Dearborn Treatment year after year.

If you are not now using Dearborn Treatment and the Dearborn Service which follows our products wherever used, we urge you to investigate it as a major economy at once. Write us. Let us send a Dearborn representative to talk with you or describe your conditions by letter and send us gallon samples of your water supplies. Address our office in Chicago at 310 S. Michigan Avenue or in New York at 205 E. 42nd Street and send water samples to 1029 W. 35th Street, Chicago.

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Bullard Co., The.
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Chucks, Quick Change.
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Chucks, Staybolt Driving.
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Ingersoll-Rand Co.
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Clamps, Machinists'.
Starrett Co., The L. S.

Clamps, Pipe.
National Malleable & Steel Castings Co.

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Whiting Corporation.

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Prime Mfg. Co.

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Landis Machine Co., Inc.
Modern Tool Works of Consolidated Machine Tool Corp. of America.
Oster Mfg. Co.
Williams Tool Co.

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Oster Mfg. Co.
Williams Tool Corp.

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National Malleable and Steel Castings Co.

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National Malleable & Steel Castings Co.

Draft Rigging and Attachments.
Cardwell Westinghouse Co.
General Steel Castings Corp.

Draft Yokes.
American Car & Fdy. Co.
National Malleable & Steel Castings Co.

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Standard Electrical Tool Co.
U. S. Electrical Tool Co.

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Gidding & Lewis Mach. Tool Co.

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Niles-Bement-Pond Co.

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General Machinery Corp. of Delaware.
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Gidding & Lewis Mach. Tool Co.
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Sellers & Co., William.

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Newton Works of Consolidated Machine Tool Corp. of America.
Sellers & Co., Inc., Wm.

Drilling Machines, Rock.
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Sullivan Machinery Co.

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Gidding & Lewis Mach. Tool Co.

Drilling Machines, Vertical.
Buffalo Forge Co.
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General Machinery Corp. of Delaware.
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Independent Pneumatic Tool Co.
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Buckeye Portable Tool Co.
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Drills, Portable Electric.
Standard Electrical Tool Co., The.
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Drills, Rock.
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Drills, Track and Bonding.
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United Eng. & Fdry. Co.

Engines, Crude and Fuel Oil
Worthington Pump & Machinery Corp.

Engines, Diesel Oil.
Worthington Pump & Machinery Corp.

Engines, Gas and Gasoline.
Ingersoll-Rand Co.
United Eng. & Fdry. Co.
Worthington Pump & Machinery Corp.

Engines, Steam.
Buffalo Forge Co.

Expanding Mandrels —. (See Arbors and Mandrel Expanding).

Expanders, Tube.
Watson-Stillman Co., The

Fans, Electric.
Buffalo Forge Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Fans, Ventilating.
Buffalo Forge Co.
General Electric Co.

Fasteners, Car Door.
National Malleable & Steel Castings Co.

Feedwater Heaters, Locomotive.
Bird-Archer Co., The.
Superheater Co., The.
Worthington Pump & Machinery Corp.

Feedwater Heaters, Stationary.
Worthington Pump & Machinery Corp.

Fencing, Iron.
Page Steel & Wire Co.

Fencing, Wire.
Page Steel & Wire Co.

Filler Rods for Electric Acetylene Welders—(See Welding Rods).

Fireboxes.
Locomotive Firebox Co.

Fittings, Air Brake.
Westinghouse Air Brake Co.

Fittings, Brass.
Lunkenheimer Co.

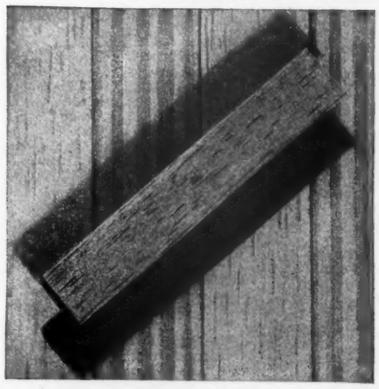
Fittings, Gas Fixtures.
Dart Mfg. Co., E. M.

Fittings, Hydraulic.
Chambersburg Engineering Co.
Watson-Sullivan Co., The.

We Took a Hint from Nature To Give You "OLD HICKORY"

Notice the *fibers* in the stick of hickory in the top photograph. Then look at the piece of etched Reading OLD HICKORY Staybolt Iron below. In both hickory and OLD HICKORY, you will see the same *fibrous* structure that means unique toughness.

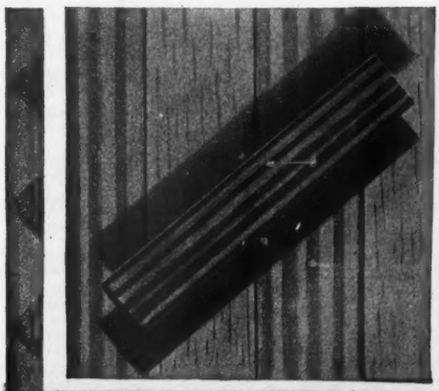
HICKORY



Hickory is tough and harder to break than other woods because Nature gave it a stauncher, *fibrous* make-up. To duplicate this structure in iron—to improve it to the highest degree of scientific efficiency—we have developed Reading OLD HICKORY Staybolt Iron.

OLD HICKORY Staybolt Iron is different from other staybolt irons because it has longer, stronger and tougher *fibers*. Reading methods of piling and heating, Reading methods of securing exceptional reduction of the checkerboard pile, produce a staybolt iron that is proof against continued vibration and metal "fatigue". That is why you can specify OLD HICKORY Staybolt Iron with the confidence that it means the utmost *safety* wherever it is used.

Let your own tests convince you that Reading OLD HICKORY Staybolt Iron is better—call our nearest representative for the facts.



Reading Bar Iron is furnished in the following sizes:
Rounds ½" to 4½" in diameter. Squares ½ to 4".
Flats 1" x ¼" to 10" x 2". Half rounds ⅞" to 1½".
Hexagons ⅝" to 1¾" inclusive.

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Boston • Cincinnati • St. Louis • Chicago • New Orleans
Buffalo • Houston • Tulsa • Seattle • San Francisco
Detroit • Pittsburgh • Los Angeles • Kansas City
Greensboro, N. C.

Only the most careful methods of piling and reduction can produce this perfect cross-section checkerboard.

READING
OLD HICKORY STAY BOLT IRON

Fixtures, Car Door.
American Car & Fdy Co.
National Malleable & Steel Castings Co.

Flanges. Pipe.
Dart Mfg. Co., E. M.

Flanges, Snow and Ice.
O. & C. Co., The

Flanging Clamps — (See Clamps, Flanging).

Flanging Presses — (See Presses, Flanging).

Floodlights, Acetylene.
Oxweld Railroad Service Co.

Flue Cutters—(See Cutters, Flue).

Flue Welders—(see Welders. Flue).

Forge Hammers.
Sullivan Machinery Co.

Forges.
Buffalo Forge Co.

Forges, Oil Rivet Heating—(See Rivet Heaters, Oil).

Forging Machines.
Ajax Manufacturing Co.
Acme Machinery Co.
National Machinery Co.

Forging Presses, Hydraulic—(See Presses, Forging).

Forgings.
American Car & Fdy. Co.
Bethlehem Steel Co.
Carnegie Steel Co.

Forgings, Drop.
American Car & Fdy. Co.

Foundry Facings.
Dixon Crucible Co., Jos.

Foundry Supplies.
American Steel Foundries.
Bird-Archer Co.
Whiting Corporation.

Frames, Truck—(See Truck Frames).

Frogs & Crossings.
Bethlehem Steel Co.

Fulcrums, Brake Beam.
American Steel Foundries.
National Malleable & Steel Castings Co.

Furnaces, Annealing.
Whiting Corporation.

Furnaces, Electric Heaters.
American Car & Fdy. Co.

Gages.
Ashton Valve Co.
Brown & Sharpe Mfg. Co.
General Electric Co.
Lunkenheimer Co.
Manning, Maxwell & Moore, Inc.
Starrett Co., The L. S.

Gages, Acetylene & Oxygen.
Oxweld Railroad Service Co.

Gage Cocks.
Lunkenheimer Co.

Gages, Dial.
Brown & Sharpe Mfg. Co.
Starrett Co., The L. S.

Gage Glasses.
Jenkins Brothers.

Gages, Height, Depth, Thickness, Screw, Etc.
Brown & Sharpe Mfg. Co.
Starrett Co., The L. S.

Gages, Oil.
Lunkenheimer Co.

Gages, Plug.
Brown & Sharpe Mfg. Co.

Gages, Pressure.
Ashton Valve Co.
Watson-Stillman Co., The

Gages, Recording.
General Electric Co.

Gages, Ring.
Brown & Sharpe Mfg. Co.

Gages, Snap.
Brown & Sharpe Mfg. Co.

Gages, Steam.
Ashton Valve Co.

Gages, Surface.
Brown & Sharpe Mfg. Co.
Starrett Co., The L. S.

Gages, Thread.
Jones & Lamson Machine Co.

Gages, Tool.
Brown & Sharpe Mfg. Co.

Gages, Wheel Press Recording.
Ashton Valve Co.

Galvanized Wire—(See Wire, Galvanized).

Gas, Acetylene—(See Acetylene Gas).

Gaskets.
Garlock Packing Co., The.
Westinghouse Air Brake Co.

Gate Shears—(See Shears, Gate).

Gear Cutting Machines.
Brown & Sharpe Mfg. Co.

Gear Shaper Cutters.
National Tool Co., The.

Gears, Cut.
General Electric Co.
United Eng. & Fdry. Co.
Westinghouse Elec. & Mfg. Co.

Gears, Fabric.
General Electric Co.

Gears, Special, Cut to Order.
Brown & Sharpe Mfg. Co.

Generators, Electric.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Gloves (See Welders' Gloves)

Goggles—(See Welders' Goggles).

Graphite, Boiler.
Dixon Crucible Co., Jos.

Grates.
Firebar Corp.

Grate Shakers.
Franklin Ry. Supply Co.

Grease Forming Machines.
Franklin Ry. Supply Co.

Grease Cups.
Lunkenheimer Co.

Grease Guns, High Pressure.
Reliance Machine & Stamping Wks., Inc.

Greases.
Dixon Crucible Co., Jos.

Grinders, Crank Pin, Portable.
Micro Machine Co.

Grinders, Cylinder.
Hutto Engineering Co.
Sundstrand Machine Tool Co.

Grinders, Portable Bench.
Standard Electrical Tool Co.
U. S. Electrical Tool Co.

Grinders, Rod, Portable Pneumatic.
Independent Pneumatic Tool Co.

Grinders, Selective Speed.
U. S. Electrical Tool Co.

Grinders, Snagging.
Standard Electrical Tool Co.

Grinding Machines.
Standard Electrical Tool Co.
U. S. Electrical Tool Co.

Grinding Machines, Bench Type.
Standard Electrical Tool Co.
U. S. Electrical Tool Co.

Grinding Machines, Chucking.
Heald Machine Co.
Modern Tool Works of Consolidated Machine Tool Corp. of America.

Grinding Machines, Cutter and Reamer.
Brown & Sharpe Mfg. Co.
Ingersoll Milling Machine Co.
Landis Tool Co.
Thompson Grinder Co., The.

Grinding Machines, Cylindrical.
Brown & Sharpe Mfg. Co.
Heald Machine Co.
Landis Tool Co.
Modern Tool Works of Consolidated Machine Tool Corp. of America.
Sundstrand Machine Tool Co.
Thompson Grinder Co., The.

Grinding Machines, Die.
Acme Machinery Co., The.
Geometric Tool Co., The
Landis Machine Co.
Modern Tool Works of Consolidated Machine Toool Corp. of America.
National Machinery Co.
Standard Electrical Tool Co.
U. S. Electrical Tool Co.

Grinding Machines, Drill.
Sellers & Co., Inc., Wm.

Grinding Machines, Edge.
Thompson Grinder Co., The.

Grinding Machines, Electric.
Standard Electrical Tool Co.
U. S. Electrical Tool Co.

Grinding Machines, Floor Type.
Modern Tool Works of Consolidated Machine
Standerd Electrical Tool Co.
Tool Corp. of America.
Sundstrand Machine Tool Co.
U. S. Electrical Tool Co.

Grinding Machines, Gap.
Landis Tool Co.

Grinding Machines, Internal.
Heald Machine Co.
Landis Tool, Co.
Micro Machine Co.
Standard Electrical Tool Co.
Sundstrand Machine Tool Co.
Modern Tool Works of Consolidated Machine Tool Corp. of America.
Thompson Grinder Co., The.
U. S. Electrical Tool Co.

Grinding Machines, Locomotive Frame, Portable Pneumatic.
Buckeye Portable Tool Co.

Grinding Machines, Portable, Electric.
Cleveland Pneumatic Tool Co.
Independent Pneumatic Tool Co.
General Electric Co.
Standard Electrical Tool Co.
U. S. Electrical Tool Co.

Grinding Machines. Portable, Pneumatic.
Buckeye Portable Tool Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.

Grinding Machines, Radius.
Sundstrand Machine Tool Co.

Grinding Machines, Surface, Horizontal Spindle.
Sundstrand Machine Tool Co.
Thompson Grinder Co., The.

Grinding Machines, Surface.
Brown & Sharpe Mfg. Co.
Sundstrand Machine Tool Co.
U. S. Electrical Tool Co.

Grinding Machines, Surface Rotary Table.
Heald Machine Co.

Grinding Machines, Tool.
Standard Electrical Tool Co.
Brown & Sharpe Mfg. Co.

Grinding Machines, Universal.
Brown & Sharpe Mfg. Co.
Modern Tool Works of Consolidated Machine Tool Corp. of America.
Thompson Grinder Co., The.

Grinding Machines, Universal Tool.
Landis Tool Co.
Sellers & Co., Inc., Wm.

Grinding and Polishing Machines.
Modern Tool Works of Consolidated Mach. Tool Corp. of America.
Standard Electrical Tool Co.
U. S. Electrical Tool Co.

Grips, Cable & Rod.
Clark Mfg. Co., The.

Ground Rods.
Page Steel & Wire Co.

Guard Rails—(See Rails, Guard).

Guards, Machine.
Page Steel & Wire Co.

Hack Saw Machines, Power—(See Sawing Machines, Power Hack).

Hack Saws — (See Saws, Hack).

Hammers, Air.
Ingersoll-Rand Co.

Hammers, Belt and Motor Driven.
Chambersburg Engineering Co.

Hammers, Board Drop.
Chambersburg Engineering Co.

Hammers, Drop.
Chambersburg Engineering Co.
Niles-Bement-Pond Co.
United Eng. & Fdry. Co.

Hammers, Forging.
Chambersburg Engineering Co.

Hammers, Pneumatic.
Cleveland Pneumatic Tool Co.
Ingersoll-Rand Co.

Hammers, Pneumatic Forging.
Chambersburg Engineering Co.
General Machinery Corp. of Delaware.
Independent Pneumatic Tool Co.
Sullivan Machinery Co.

Hammers, Power, Belt and Motor Driven.
Quickwork Co., The.

Hammers, Riveting.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.

Hammers, Sheet Metal.
Quickwork Co., The.

Hammers, Steam.
Sellers & Co., Inc., Wm.

Hammers, Steam Forging.
General Machinery Corp. of Delaware.

Hammers, Steam and Steam Drop.
Chambersburg Engineering Co.

Hand Tools.
Starrett Co., The L. S.

Hangers.
S. K. F. Industries, Inc.

Hangers, Shaft.
Brown & Sharpe Mfg. Co.
Sellers & Co., Inc., Wm.

Headlights, Electric.
General Electric Co.

Heaters.
Westinghouse Elec. & Mfg. Co.

Heaters, Oil—(See Oil Heaters).

Heaters, Rivet Electric—(See Rivet Heaters, Electric).

Heating Systems, Car (Electric).
Wine Railway Appliance Co.

Helium.
Oxweld Railroad Service Co.

High Speed Steel — (See Steel, High Speed).

Hobs.
Brown & Sharpe Mfg. Co.
National Tool Co., The.

Hobbing Machines, Gear, Spur and Spiral.
Brown & Sharpe Mfg. Co.

Hoists, Air.
Hanna Engineering Works
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Whiting Corporation.

Hoists, Coach.
Whiting Corporation.

Hoists, Electric.
American Engineering Co.
General Electric Co.
General Machinery Corp. of Delaware.
Harnischfeger Corp.
Shepard Niles Crane & Hoist Corp.
Westinghouse Elec. & Mfg. Co.

Hoists, Hand.
General Machinery Corp. of Delaware.

Hoists, Hydraulic.
Chambersburg Engineering Co.

Hoists, Locomotive.
Whiting Corporation.

Hoists, Portable.
Ingersoll-Rand Co.
Whiting Corporation.

Hoists, Transformer.
Harnischfeger Corp.
Shepard Niles Crane & Hoist Corp.
Whiting Corporation.

Hook & Roller Bars.
Clark Mfg. Co. The.

Hooks, Wrecking.
National Malleable & Steel Castings Co.

Hose Air.
Ingersoll-Rand Co.
Westinghouse Air Brake Co.

Hose, Air Brake.
Westinghouse Air Brake Co.

Hose Clamp Tool.
Ingersoll-Rand Co.

Hose Couplings—(See Couplings Hose).

Hose, Flexible Metallic.
Barco Mfg. Co.
Franklin Ry. Supply Co.

Hose Welding.
Oxweld Railroad Service Co.

Hydraulic Machinery.
Bethlehem Steel Co., Inc.
Chambersburg Engineering Co.
General Machinery Corp. of Delaware.
Ingersoll-Rand Co.
United Eng. & Fdry. Co.
Watson-Stillman Co., The.

Indicators, Speed and Test.
Brown & Sharpe Mfg. Co.

Ingots.
American Rolling Mill Co.
Bethlehem Steel Co. Inc.
Carnegie Steel Co.

Injectors.
Sellers & Co., Inc. Wm.

Injectors Live and Exhaust Steam.
Sellers & Co., Inc., Wm.
Superheater Co., The.

Injectors, Feedwater Heater. Exhaust Steam.
Sellers & Co., Inc., Wm.

Injectors, Live Steam, Locomotive.
Sellers & Co., Inc., Wm.

Instruments, Precision Measuring.
Brown & Sharpe Mfg. Co.

Insulating Materials.
General Electric Co.

Intensifiers, Hydraulic.
Chambersburg Engineering Co.

Iron, Bar.
Highland Iron & Steel Co.
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Iron, Charcoal.
Wrought Iron Research Ass'n.

Iron, Ingot.
American Rolling Mill Co.

Iron, Pig.
Bethlehem Steel Co.
Carnegie Steel Co.

Iron, Staybolt.
Bethlehem Steel Co.
Wrought Iron Research Ass'n.

Iron, Wrought.
Highland Iron & Steel Co.
Wrought Iron Research Ass'n.

Iron Cement.
Smooth-On Mfg. Co.

Jacks, Bridge & Building.
Clark Mfg. Co., The.

Jacks, Frame & Bolt.
Clark Mfg. Co., The.

Jacks, Locomotive & Tender Connections.
Clark Mfg. Co., The.

Jacks, Hydraulic.
Watson-Stillman Co., The

Jigs and Fixtures.
Brown & Sharpe Mfg. Co.
Gidding & Lewis Mach. Tool Co.
Ingersoll Milling Machine Co., The.

Joggling Machines.
Quickwork Co., The.

Joints, Air Reservoir.
Barco Mfg. Co.
Franklin Ry. Supply Co.

Joints, Coach.
Franklin Ry. Supply Co.

Joints, Coach Yard.
Barco Mfg. Co.

Joints, Flexible Ball.
Barco Mfg. Co.
Franklin Ry. Supply Co.

Joints, Flexible for Engine Tender Connections.
Barco Mfg. Co.
Franklin Ry. Supply Co.

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Bethlehem Steel Co., Inc.
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Joints, Roundhouse Blower Line.
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There are numerous places in every plant where these untiring helpers should be helping to cut handling costs. Some typical applications are given in the "Book of Illustrated Economies". You may find some helpful suggestions within its pages. Write for a copy.

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Knuckle Emergency (For Couplers).
Q. & C. Co., The.

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Ladders, Steel Car.
Wine Railway Appliance Co.

Ladle Heaters — (See Heaters, Ladle).

Lamps, Incandescent.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lathes, Automatic Chucking and Turning.
Bullard Co., The.
Jones & Lamson Machine Co.
Monarch Machine Tool Co., The.
Sundstrand Machine Tool Co.

Lathes, Axle.
Betts Works of Consolidated Machine Tool Corp. of America.
General Machinery Corp. of Delaware.
Manning, Maxwell & Moore, Inc.
Monarch Machine Tool Co., The.
Sellers & Co., Inc., Wm.

Lathes, Brass.
Consolidated Mach. Tool Corp. of America.

Lathes, Burnishing.
Manning, Maxwell & Moore, Inc.

Lathes, Car Wheel.
Betts Works of Consolidated Machine Tool Corp. of America.
General Machinery Corp. of Delaware.
Manning, Maxwell & Moore, Inc.
Monarch Machine Tool Co., The.
Ryerson & Son, Jos. T.
Sellers & Co., Inc., Wm.

Lathes, Driving Wheel.
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General Machinery Corp. of Delaware.
Manning, Maxwell & Moore, Inc.
Monarch Machine Tool Co., The.
Ryerson & Son, Jos. T.
Sellers & Co., Inc., Wm.

Lathes, Engine.
Betts Works of Consolidated Machine Tool Corp. of America.
Manning, Maxwell & Moore, Inc.
Monarch Machine Tool Co., The.

Lathes, Engine Attachments.
General Machinery Corp. of Delaware.
Monarch Machine Tool Co., The.
Ryerson & Son, Jos. T.

Lathes, Extension and Gap.
General Machinery Corp. of Delaware.
Monarch Machine Tool Co., The.
Ryerson & Son, Jos. T.

Lathes, Journal Truing.
Betts Works of Consolidated Machine Tool Corp. of America.
General Machinery Corp. of Delaware.
Manning, Maxwell & Moore, Inc.
Monarch Machine Tool Co., The.

Lathes, Production Turning.
Sundstrand Machine Tool Co.

Lathes, Turret.
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Bullard Co., The.
Jones & Lamson Mach. Co.
Monarch Machine Tool Co., The.

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Oxweld Railroad Service Co.

Line Shaft.
SKF Industries, Inc.

Locomotive Exhaust Steam Injectors.
The Superheater Co.

Locomotive Feed Water Heaters.
Superheater Co., The.
Worthington Pump & Machinery Corp.

Locomotive Frame Drilling Machines.
Gidding & Lewis Mach. Tool Co.
General Machinery Corp. of Delaware.

Locomotive Frame Grinding Machines, Portable Pneumatic.
Buckeye Portable Tool Co.

Locomotive Guide Liners.
Starrett Co., The L. S.

Locomotive Repair Equipment
Rooksby & Co., E. J.
Underwood Corp., H. B.

Locomotive Throttles.
American Throttle Co.

Locomotives.
American Locomotive Co.
Baldwin Locomotive Wks., The.
General Electric Co.
Ingersoll-Rand Co.
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Westinghouse Elec. & Mfg. Co.

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Bethlehem Steel Co., Inc.

Locomotives, Compressed Air.
Baldwin Locomotive Co.

Locomotives, Contractors'.
American Locomotive Wks.
Baldwin Locomotive Wks., The.
Lima Locomotive Works. The.

Locomotives, Electric.
American Locomotive Co.,
Baldwin Locomotive Wks.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Locomotives, Mine.
Baldwin Locomotive Wks., The.
General Electric Co.

Locomotives, Oil Engine Elec. Driven.
American Locomotive Co.
General Electric Co.
Ingersoll-Rand Co.

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Hennessy Lubricator Co.
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Reliance Machine & Stamping Wks., Inc.
U. S. Graphite Co.

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Dixon Crucible Co., Joseph.
Lunkenheimer Co.
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Hennessy Lubricator Co.

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Chambersburg Engineering Co.

Machinery, Woodworking and Sawing.
Buffalo Forge Co.

Machinists' Tools — (See Tools, Machinists').

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Buffalo Forge Co.

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Ford Co., The J. B.
National Equipment Co., Inc.
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Metallic Packing—(See Packing, Metallic).

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Millers, Frame Jaw.
Micro Machine Co.

Milling Attachments.
Ingersoll Milling Machine Co.
Rooksby & Co., E. J.
Underwood Corp., H. B.

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Brown & Sharpe Mfg. Co.
Geometric Tool Co., The.
Gidding & Lewis Mach. Tool Co.
Ingersoll Milling Mach. Co.
Modern Tool Works of the Consolidated Mach. Tool Corp. of America.
National Twist Drill Co.
Niles Tool Works Co.

Milling Machines, Automatic.
Brown & Sharpe Mfg. Co.
Ingersoll Milling Mach. Co.
Sundstrand Machine Tool Co.

Milling Machines, Continuous Circular.
Ingersoll Milling Mach. Co.
Newton Machine Tool Works of the Consolidated Machine Tool Corp. of America.

Milling Machines, Hand.
Brown & Sharpe Mfg. Co.
Sundstrand Machine Tool Co.

Milling Machines, Heavy Duty.
Brown & Sharpe Mfg. Co.
Sundstrand Machine Tool Co.

Milling Machines, Horizontal.
Betts Works of Consolidated Mach. Tool Corp. of America.
Gidding & Lewis Mach. Tool Co.
Ingersoll Milling Machine Co., The.
Lucas Machine Tool Co.
Niles-Bement-Pond Co.
Sellers & Co., Inc., Wm.
Sundstrand Machine Tool Co.

Milling Machines, Horizontal, Plain.
Gidding & Lewis Mach. Tool Co.
Ingersoll Milling Mach. Co.
Lucas Machine Tool Co.
Newton Works of Consolidated Machine Tool Corp. of America.
Niles Tool Works Co.
Sundstrand Machine Tool Co.

Milling Machines, Horizontal, Universal.
Ingersoll Milling Mach. Co.
Sundstrand Machine Tool Co.

Milling Machines, Keyseat.
Ingersoll Milling Mach. Co.
Newton Works of Consolidated Machine Tool Corp. of America.

Milling Machines, Plain.
Brown & Sharpe Mfg. Co.
Sundstrand Machine Tool Co.

Milling Machines, Planer Type.
Sellers & Co., Inc., Wm.

Milling Machines, Portable.
Gidding & Lewis Mach. Tool Co.
Newton Works of Consolidated Machine Tool Corp. of America.
Rooksby Co., E. J.
Underwood Corp., H. B.

Milling Machines, Radius.
Ingersoll Milling Mach. Co.
Newton Works of Consolidated Machine Tool Corp. of America.

Milling Machines, Slab.
Ingersoll Milling Co.
Newton Works of Consolidated Machine Tool Corp. of America.
Niles Tool Works Co.

Milling Machines, Tread.
Newton Works of Consolidated Machine Tool Corp. of America.

Milling Machines, Universal.
Brown & Sharpe Mfg. Co.
Sundstrand Machine Tool Co.

Milling Machines, Vertical.
Betts Works of Consolidated Machine Tool Corp. of America.
Brown & Sharpe Mfg. Co.
Ingersoll Milling Mach. Co.
Newton Works of Consolidated Machine Tool Corp. of America.
Niles Tool Works Co.
Sundstrand Machine Tool Co.

Mining Machinery.
Ingersoll-Rand Co.
Lima Locomotive Works.
Lucas Machine Tool Co.

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Hanna Engineering Works.

Monorail Systems.
Whiting Corporation.

Motors, Electric.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Movers, Locomotive.
Whiting Corporation.

Multiple Drills—(See Drilling Machines, Multiple Spindle).

Multiple Punches — (See Punching Machines, Multiple).

Nails, Copper Covered.
Page Steel & Wire Co.
Reading Iron Co.

Nails, Cut.
Reading Iron Co.

Nipple Threading Machines.
Landis Machine Co.

Nitrogen.
Oxweld Railroad Service Co.

Nozzles, Oxy-Acetylene Cutting.
Oxweld Railroad Service Co.

Nozzles, Exhaust.
Franklin Ry. Supply Co.

Nut Burring Machines.
National Machinery Co., The.

Nut Driving Machines, Portable Pneumatic.
Buckeye Portable Tool Co.

Nut Facing Machines.
Landis Machine Co.

Nut Couplings.
Sellers & Co., Inc., Wm.

Nut Machines.
National Machinery Co., The.

Nut Steel—Bronze Coupling.
Sellers & Co., Inc., Wm.

Nut Tapper—(See Bolt and Nut Machinery).

Nut Tapping Machines.
National Machinery Co., The.

Nuts, Castellated.
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Hilles & Jones Works of Consolidated Machine Tool Corp. of America.
Underwood Corp., H. B.
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Planers, Rotary.
General Machinery Corp. of Delaware.
Newton Works of Consolidated Machine Tool Corp. of America.
Underwood Corp., H. B.

Planers, Valve Seat.
Rooksby & Co., E. J.
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Underwood Corp., H. B.
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Platforms, Car.
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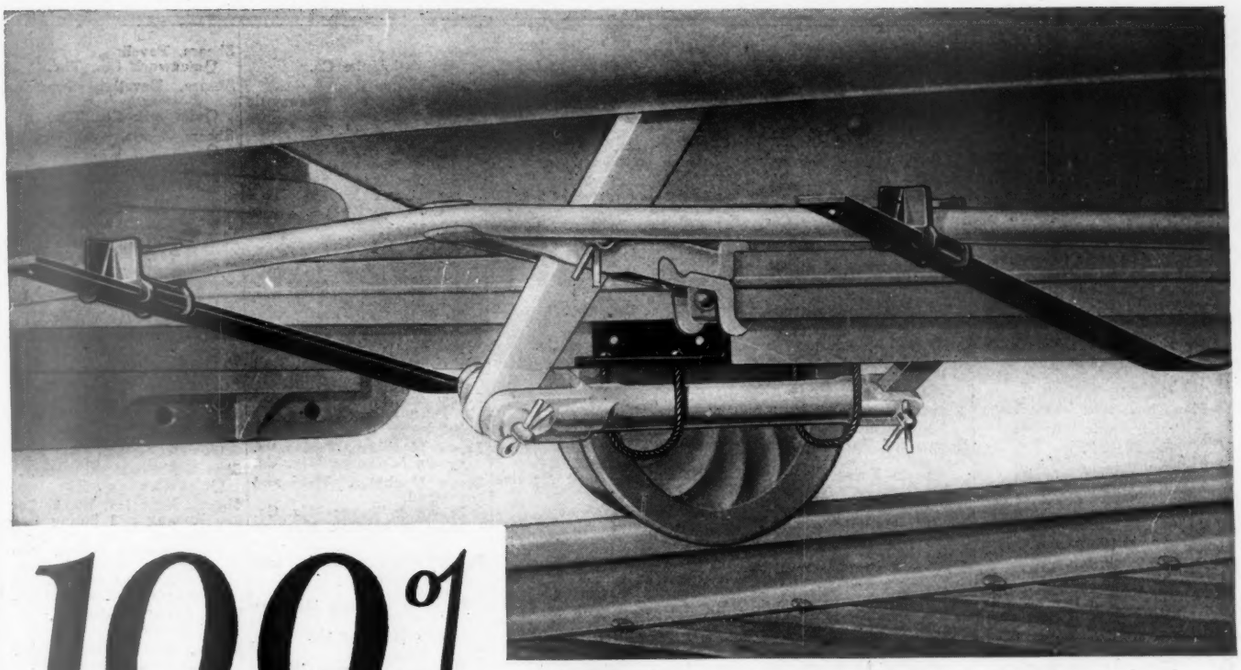

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Chambersburg Engineering Co.
Hanna Engineering Works.
Watson-Stillman Co., The.
Wood & Co., R. D.

Riveters, Pinch Bug.
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Riveters, Pneumatic — (See Hammers, Pneumatic).

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Quickwork Co., The.

Shearing Machine, Gate.
Cleveland Punch & Shear Works Co., The.
Hilles & Jones Works of Consolidated Mach. Tool Corp. of America.

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Quickwork Co., The.

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Water Cages and Alarms.
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Water Conditioners, Locomotive.
Bird-Archer Co., The
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Dearborn Chemical Co.
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Water Treatment.
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Wedges, Automatic.
Franklin Ry. Supply Co.
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Weed Burners.
General Steel Castings Corp.
Welding and Cutting Apparatus—(See Cutting and Welding Apparatus).
Welding Gas.
Oxweld Railroad Service Co.
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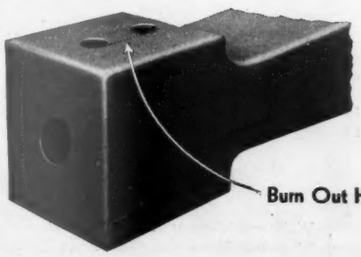

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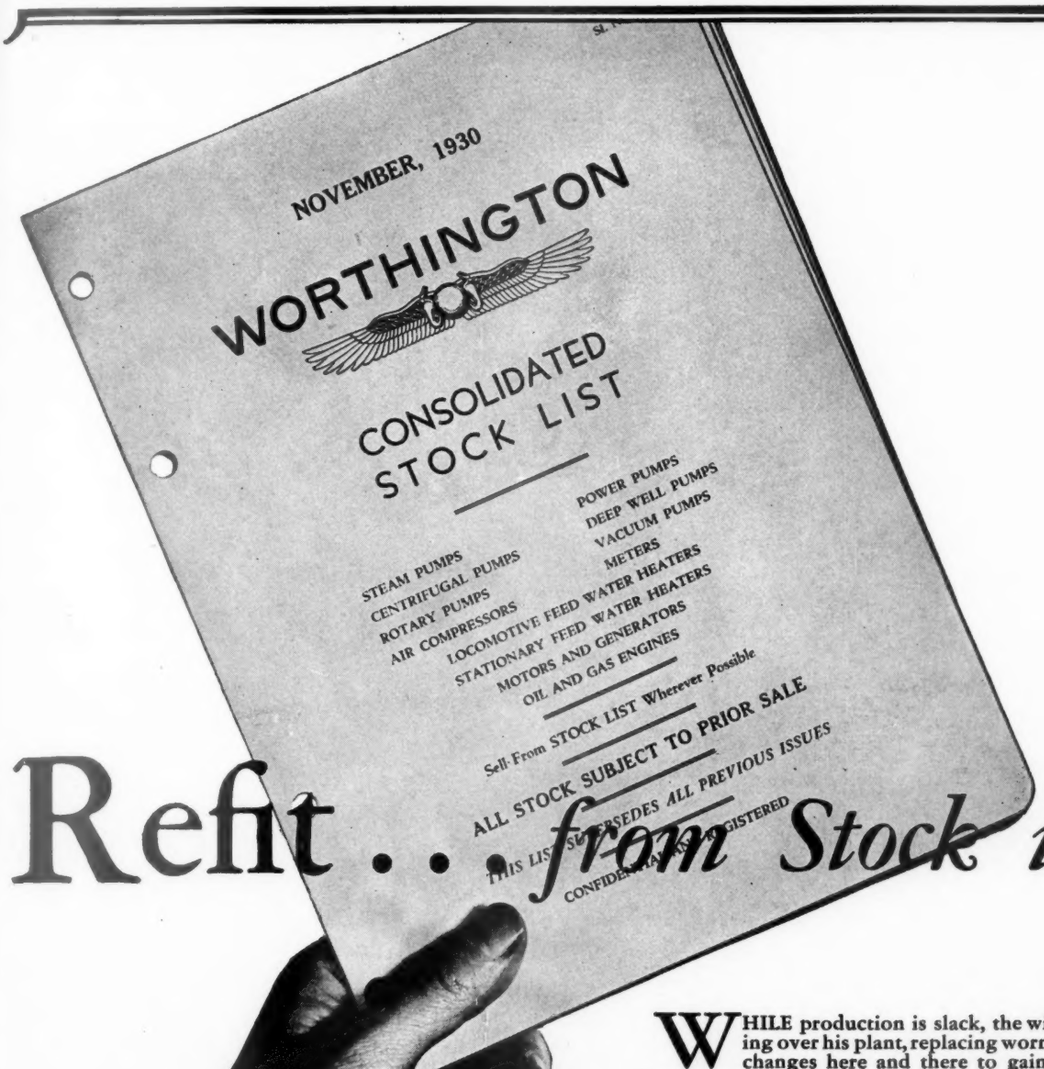

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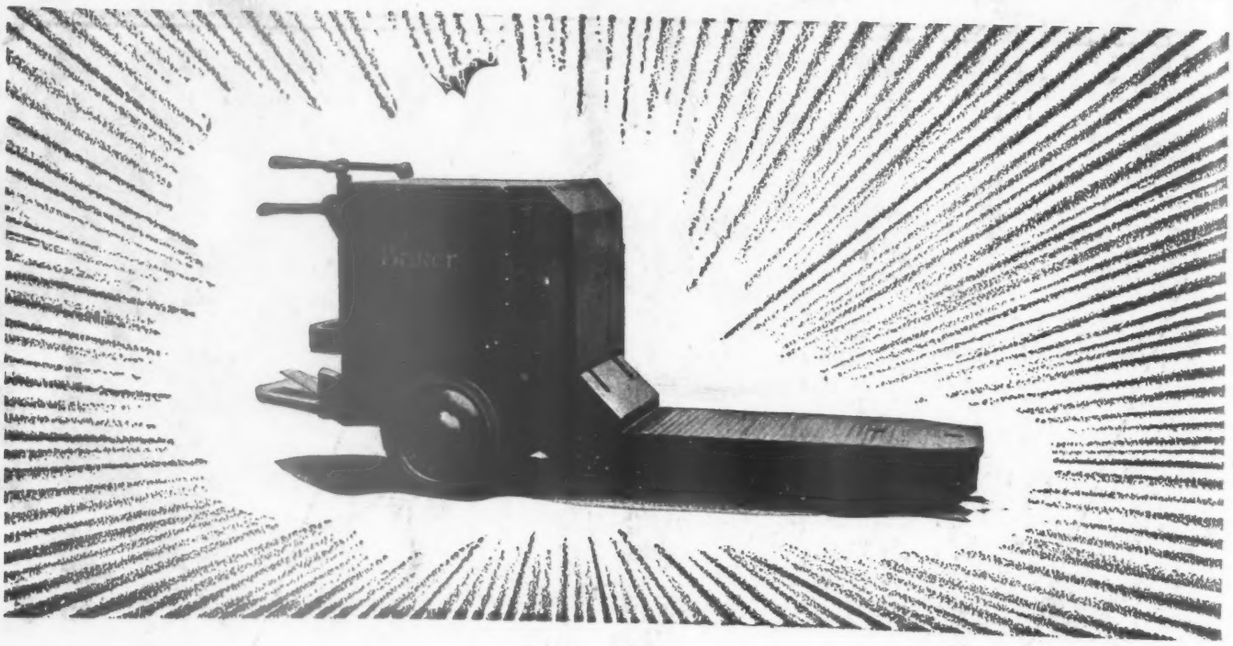

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